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POWER TRANSMISSION IN MEXICO.

This week we bring to a conclusion the interesting article by Mr. Doble on the Guanajuato power transmission. This is a striking example of the methods and boldness with which modern electrical engineers attack the problems of the delivery of the electric current in large volume and high pressure over long distances; and it is both interesting and encouraging to note that, while other work of the same kind is already being carried out in Mexico, further plans of a similar character are already projected in the same progressive republic. In fact, it would hardly be going too far to say that the activity in power transmission in Mexico at the present moment is fully equal to that which is being manifested within our own country, whether as to the distance or voltage or the amount of investment involved.

Editorial note has already been made of the chief features connected with this plant, but attention may here be called to the fact that the present installment deals largely with the somewhat novel pole line transmission. The circuits instead of being held up by strong ordinary poles, such, for example, as may be seen between Niagara and Buffalo, are supported by special galvanized steel structures weighing about 1,500 pounds each, and spaced 440 ft. apart, or about 12 per mile, except near Guanajuato, where a few 60-ft towers have been employed with spans up to 1,320 ft. in length. Full details are given with regard to this line in our article, and it will be very interesting to watch the results with this construction, which bids fair to be duplicated in much of this work. While not exactly original, it is, we believe, unique as to its present extensive adoption; and the engineers concerned appear to have no reason to doubt the wisdom of their decision in this respect.

TELEPHONE POLE LINES.

While underground conduits and wires have become the prevalent and permanent feature of electrical work in all larger cities on this continent, it will be a very long time before all aerial circuits disappear, not only across country, but in hundreds and hundreds of communities where the conditions do not admit or require resort to the more expensive methods of initial construction. Telephony with its profusion of circuits has, even more than telegraphy, been a great sinner in the way of disfiguring the streets and roads with these necessary overhead wires, but even in the smallest town or village improvement is possible if the latest scientific methods are adopted. Thus we illustrate and describe in this issue the installation effected at Austin, Minn., by Mr. L. W. Stanton, which is based entirely upon cables on the poles instead of the use of separate single wires strung along from pole to pole like a huge birdcage or aeolian harp and constituting a positive eyesore. It may be said that this all-cable practice reduces the cost of operation and maintenance to a minimum, eliminates a large number of cross-arms and bare wires, and enhances in general, and quite markedly, the efficiency of the service.

Attention may also be directed to the terminals at which connections are made directly to the subscriber to be served, from the cable on the pole nearest to him. It may well be understood that in planning such a system considerable thought has to be given to the ratio of fluctuation or demand for service between large and small groups of subscribers. At Austin one of the cables of 150

pairs distributes to a portion of the city where the service has reached the proportion of a telephone to every seven inhabitants, yet the plant was so planned that it was possible to increase the capacity 30 per cent. in this overloaded district at an expense of less than one-sixth of that usually incurred with the open-wire method, which it would seem ought soon to become almost entirely a thing of the past.

THE RUSTING OF IRON.

The *Proceedings* of the Chemical Society have recently published a summary of a yet incomplete inquiry into the chemical reactions involved in the rusting of iron. The results suggest that electrolytic action is involved. It seems that when pure iron is left in contact with dry oxygen it does not rust. Moreover, iron does not rust when left in contact with mixed oxygen and water vapor, so long as the temperature is kept constant. If, however, the temperature be allowed to fluctuate, so that the water vapor condenses in water on the iron, rusting takes place. Again, rusting is stated not to occur if pure iron is immersed in pure water free from oxygen. But if the water absorbs oxygen, rusting occurs. Consequently, it would seem that the rusting of pure iron requires the presence both of liquid water and of oxygen, neither being in itself sufficient. A large number of attempts have been made to produce a non-rusting iron, or to give a surface to iron which will not rust. Nickel plating is the best expedient which has been found, although there are manifestly many cases in which this expedient cannot be applied. Any cheap plan which would enable surfaces of iron and steel to be preserved from rusting would add materially to the world's wealth, because, at the present time, the annual rate of destruction of steel commodities, rails and structures aggregates a gigantic international loss. It would be well worth while conducting extensive experimental researches in this direction at the expense of communities or governments, in the hope of arriving at some more generally available expedient than nickel plating, which is only effective under special conditions.

The subject is usually regarded as entirely within the province of chemistry, but this is by no means necessarily the case. In the first place, the existing expedient of nickel plating is an electrolytic process and is, therefore, a subject of electrical interest. In the second place, the nature of rusting seems to involve electrolytic action, so that a complete comprehension of the phenomenon is likely to extend beyond the limits of chemistry, as ordinarily defined. We are accustomed to regard with dismay the destruction of iron pipes, which may occur in the ground owing to the electrolytic action of stray currents from a trolley system; but the wholesale steady destruction of iron both above and below ground, owing to natural rusting, is a far more important factor in the depreciation of general wealth.

SPEED CONTROL OF DIRECT-CURRENT MOTORS.

In the present state of the art, the performance of direct-current generators and motors may be predetermined with a degree of accuracy hardly surpassed in any line of engineering, and the design of such machines has settled down into well-defined channels. With few exceptions, the electrical constants of a machine may be ascertained directly without resorting to empirical equations, such equations, however, being essentially necessary as regards the mechanical constants. A prominent exception is found in the commutation characteristics of various designs. Much experimental work has been done looking to the determination of the commutation limits as affected by the shape of poles, polar arcs, turns per segments, coils per slot, magnetomotive force of armature and field coils, shape of slots, brush widths, length of armature and throw-off coils, etc. The fact remains, however, that the equations for expressing the commutation limits are as yet wholly empirical, the constants for which must be determined for each type of machine, and hold true merely for various sizes of the same, or similiar, design.

If there have been found or determined reliable equations and constants applicable to all types and sizes of direct-current machines of all makes, such equtations have not appeared in print and must be preserved in the archives of the manufacturing companies. As concerns the commutation, the design of direct-current machines is, and doubtless will remain, largely one of cut and dry. The fact that the maximum current for most commercial designs is limited by the heating of the armature conductors, has lessened the need for accurate determination of the commutation limit, and, in many cases, has relieved the designer of the burden or resorting to cut and try methods. Within relatively recent years atempts have been made to meet the demand for adjustable-speed shunt-wound motors for the operation of machine tools. The solution of the problem, in many cases, has involved numerous complications, such as, multivoltage generators and diseributing circuits, double-commutators and variable reluctance motors.

It is a fact which needs no proof that, all other conditions being he same, the most satisfactory system is one which employs a variable-speed motor which relies solely upon shunt field-resistance control. It should be a matter of considerable importance to the profession that even at this date there can be found upon the market motors, which without added complications, allow of a speed variation of 4 to 1 or 5 to 1 by means of shunt-field control. In the operation of such a motor the limit to the upper range of speed variation is closely dependent upon the commutation properties of the machie, and the designer is forced to rely upon experience for determining the proper proportion of parts. Any method of testing which will allow of systematic investigation of the eflect upon the commutation of various changes in the constants of design or operation, cannot fail to be of benefit to the further development of this type of motor.

COMMUTATION TESTS.

The sensitive part of a direct-current dynamo is its commutator. If the commutator is in good condition and operates satisfactorily, the machine is likely to be in good working order. Although the commutator of a dynamo is a device about half a century old, and, therefore, hoary-headed by comparison with many devices of dynamo-electric machinery, yet our knowledge concerning its full operation is very deficient. This deficiency does not arise from neglect, because both the practical behavior of commutators and the theory of commutation have received much study. The deficiency arises from the great complexity of the phenomena involved, their brief cyclic interaction and the difficulty of making such cyclically rapid actions readily apparent. Ideal commutation requires that the current in any coil shall reverse steadily, and with constant gradient, as the brush passes over its commutator segments. This condition in the coil would involve the conditions in the brush that the current flow through any cross-section should be steady; that sections perpendicular to the brush length should be equipotential surfaces, and that the current density at the surface of contact with the commuator should be uniform and constant, except in so far as the mica separators may introduce temporary cessations of flow immediately over them.

It is needless to say that these ideal conditions are never, and apparently can never, be attained in practice. The current density in the brush surface pulsates cyclically, the equipotential surfaces in the mass of the brush pulsate rapidly and the current in each

coil reverses in a gradient that is quite ununiform. The most direct method of studying the phenomena of current commutation in any one coil would be to insert in the circuit thereof a pair of slip rings, lead these out to an oscillograph and photograph the current flow during reversal under varying conditions. This method is effective in bringing the actual current variation to light, but it is necessarily slow and laborious. A second method, which is somewhat availed of, is to study the potential difference between opposite edges of a single brush, either by averages as indicated on a portable voltmeter, or by oscillograph, for successive instantaneous actions. This method is simpler than the first, because it requires neither cutting armature loops, nor the addition of slip rings; so that the armature is not marred in any way. On the other hand, however, the actions within the coil can only be inferred and are liable to be masked by superposed effects. A third method is to study the difference of potential between a particular point or points on the brush, near its contact surface and the surface of the commutator immediately beneath.

A modification of this method is the subject of an article elsewhere in this issue, page 289, by Mr. Arthur Keller. In this article, a number of equidistant points are marked on the brush near its contact surface and the average potential difference tween the immediately adjacent commutator surface and these points is successively measured by a low-reading voltmeter. Owing to the purposely imperfect conductivity of the brush, there is a very appreciable difference between these successive potential differences. From the curve of these potential differences, as plotted with respect to brush-contact length, much information can be gleaned concerning the conditions of commutation. If the commutation were perfect, all these potential differences would be equal, and the curve would be a horizontal line. The greater the departure of the curve from the horizontal, the more imperfect the commutation, other things being equal. The calculation of the current strength and its variation, in the armature coils under commutation, is not, however, susceptible of precise computation from these observations owing to the fact that the individual readings of potential difference are but average during a cycle, and also that they are modified by the conductivity of the brush. Even the graphical method used for ascertaining the current from the e.m.f. curve is open to the criticism that the location of the current curve will depend to some extent upon the number of reference points chose. Nevertheless, for practical purposes, the potential difference curve is a good index as to the nature of the commutation, and also as to the resistance offered by the brush contact surface forming part of the armature circuit.

FLICKERING OF INCANDESCENTS AT LOW FREQUENCY.

It is, of course, well known that incandescent lamps fed by alternating currents of low frequency flicker perceptibly owing to the fact that the current passes through zero every half period, while the resulting cooling of the filament becomes conspicuous if the frequency be low enough. The lower limit of frequency in good lighting with incandescents is pretty well known to be at about 30 periods per second for 110-volt lamps of ordinary efficiency. The slenderer the filament the more sensitive is the lamp to fluctuations of this kind, for the lower then is the thermal inertia. With 50-volt lamps of 20 or 32 cp it is possible to get tolerable results even at 25 periods, while with high efficiency lamps for 200 volts or more it would probably be difficult to get good results below 35 periods. In a general way the subject has been often investigated, but the results have been rather discordant. There are two distinct questions involved in the matter, one physical, the other purely physiological. The former deals with the extent of the actual periodical variation in luminous effect; the latter with the effect of frequency on the physiological effect of a given light variation. A recent thesis from the University of Wisconsin, by Mr. H. Seaman, deals with the physical phase of the matter in a rather interesting fashion. The method followed in the investigation was to integrate the instantaneous values of the light at the same points of successive waves by means of a selenium cell used as a photometer. A slotted disc on the shaft of the alternator which supplied the lamp enabled the light at any particular point of the wave to be thus evaluated.

The selection of the selenium cell was useful as eliminating the physiological difficulties of a photometric comparison, but it involves a good deal of uncertainty as to the behavior of the cell under a rapid periodic stimulation, about which very little is really known. It strikes us offhand that a direct photometric comparison with periodic flashes at the same frequency from a direct-current lamp would have given a valuable check on the behavior of the selenium. Be that as it may, the results attained were tolerably interesting, although the idiosyncracies of the selenium cell are very evident. Briefly, it was found that the variations produced at low frequencies, say from 20 periods to 30 periods were equivalent to those resulting from a change of four or five volts in effective pressure. At 50 periods to 60 periods, on the other hand, the variations were of barely half these magnitudes. This implies that at the lower frequencies the light variation during each period covers a range of fully 25 per cent., which ought to be, and is, easily observable. The curious fact was observed that at the same effective voltage a lamp fed by alternating current affected the selenium cells more strongly than the same lamp fed by direct current, again indicating the undesirability of that particular method of photometry. As a check on the results the variations in intensity were also observed photographically. This scheme is a very familiar one in studying alternating arcs in which the periodic light variations are very great, but is far more troublesome to apply to incandescents. At the lower frequencies, however, the periodic variations were very perceptible in the photographs, although not available for quantitative results.

The physiological effects of periodic light variations of a given amount have never been satisfactorily investigated. A rather slow variation in the voltage of an incandescent lamp is certainly very noticeable, even when less in amount than the physical variations found by Mr. Seaman at 60 periods, a frequency admittedly satisfactory as regards steadiness. Evidently either the selenium cell method gave results too large at the higher frequencies or the physiological factor is altogether the controlling one in the matter. Certainly with a 110-volt, high efficiency lamp a periodicity of 20 periods is found to give an undoubtedly bad effect, while at 40 periods the light is sensibly steady. Mr. Seaman's results on the physical side of the problem are inadequate to account for the observed facts. It now remains for some one to work out the physiological side of the matter. Starting with a periodic variation of light of a known amount, say 25 per cent., which would correspond to four or five volts on the ordinary incandescent, the resulting illumination should be studied with increasing frequency. At periodicities reaching many seconds the annoying fluctuations would probably be found to be quite inconspicuous. A variation of this magnitude with a frequency in the vicinity of 1 second is certainly most troublesome to the eye, and as the frequency increases so does the trouble, at least up to a certain point. It is of material importance to determine the point at which for a given variation in intensity the fluctuation becomes imperceptible. In experimenting with an incandescent lamp on alternating current, both the absolute light variations and their physiological effects vary with the frequency. With the range of commercial frequencies the total result is that the insistent trouble with the illumination decreases more rapidly than the absolute light variation. One would perhaps not go far wrong in saying that the apparent variation effect falls off somewhere nearly as the inverse square of the frequency—certainly faster than a linear function.

The Government Wireless Report.

The United States Navy Department has published the full report of the special board appointed to investigate the subject of wireless telegraphy, which was referred to editorially in these pages last week, when the leading points were summarized. The board unanimously recommended that the navy have control of all the wireless systems along the coasts of the United States, the island possessions and the Panama Canal zone, and the President adopted the recommendation. Following are the principal conclusions of the board:

"That wireless telegraphy is of necessity to the Government through the Navy Department and that its use by the Signal Corps of the army in communication between military posts of the army and other necessary links will be necessary both in peace and in war and that such use shall be unrestricted. When interference seems probable between stations of the Navy and War Departments the question involved shall be mutually settled by representatives of the two departments.

"That coastwise wireless telegraphy is not a necessity for the work of the Weather Bureau, provided that the necessary meteorological data for that department can be collected by the stations of the Navy Department from ships at sea and by them sent to the Weather Bureau.

"That the maintenance of a complete coastwise system of wireless telegraphy by the Navy Department is necessary for an efficient and economical management of the fleets of the United States in time of peace and their efficient maneuvering in time of war.

"That the Signal Corps of the army be authorized under its chief to establish from time to time such wireless stations as he may deem necessary, and that they do not interfere with the coastwise telegraph system of the Government under control of the Navy Department.

"That the necessary steps be taken to have the Weather Bureau turn over to the Navy Department all coastwise wireless telegraph apparatus now under its control and such material as it may have in its possession which can be utilized by the Bureau of Equipment and the proper transfers of funds for this purpose be made.

"That the Weather Bureau furnish to the Hydrographic Office and to naval wireless telegraph stations and to other portions of the public service such meteorological data as it or they may desire at no cost to them.

"That the Department of Agriculture shall continue the work of its meteorological vessel reporting and storm-warning stations as now constituted and provided for by law and continue the control of seacoast telegraph systems except wireless systems.

"That the necessary steps be taken that the Navy Department may equip and install a complete coastwise telegraph system covering the entire coasts of the United States, its insular possessions and canal zone in Panama.

"That the wireless stations of the Navy Department shall, without charge to the Agricultural Department, receive and promptly transmit to the ocean or to islands or to other places where the information can be useful the storm warnings of the Weather Bureau.

"That the Navy Department shall request all vessels having the use of its wireless stations for the receipt of messages to take daily meteorological observations of the weather when within connecting range and to transmit such observations to the Weather Bureau through naval wireless stations at least once daily and transmit observations oftener when there is a marked change in the barometer, and that there shall be no charge against the Agricultural Department for these observations or for the transmission thereof.

"As fast as the naval wireless telegraph stations are in operation the Navy Department shall receive and transmit through these stations free of charge all wireless messages to and from ships, providing such stations do not come in competition with commercial stations, until such time as Congress may enact the necessary legislation governing this subject.

"In asking for legislation on this point the board invites attention to the fact that where wireless stations are needed for the merchant marine, as a rule, the navy will also require them. The board believes it to be in the interest not only of governmental but of public economy and efficiency to permit the naval stations to handle the public service, for, in the present state of the art but one station is desirable for the public interest in such places. It is admitted that there may be special cases where private stations can serve a useful purpose, and the board believes that the Department of Commerce and Labor should have the duty of issuing licenses in such cases under such regulations as will prevent interference with stations necessary to the national defence. All private stations in the interior of the country should also be under the supervision of the Department of Commerce and Labor."

The Street Railway Plans of the New York Central.

Details have been given in these pages recently as to the acquisition by the New York Central & Hudson River Railroad of various trolley networks in New York State, and of its plans for further purchases in this direction. An important interview in the *Street Railway Journal*, with Mr. Horace E. Andrews, now throws more light on this interesting subject. By the purchase of 51 per cent. of the stock of the Andrews-Stanley properties, including the Syracuse Rapid Transit Company, the Vanderbilt interests have secured control of the key to the traction situation in Central New York, and at the same time the co-operation of these aggressive traction operators. Now it appears to be the intention of the New York Central interests to extend the traction system entirely across New York State. This will be done by acquiring existing traction properties where it is deemed desirable, and by electrifying portions of the West Shore Railroad, which parallels the New York Central across New York, and which is also owned by the Vanderbilt interests. The first step in this work will be to electrify that portion of the West Shore between Utica and Syracuse, and this will be done immediately. It is also the intention to electrify the Auburn branch of the New York Central, operating between Syracuse and Rochester, over a longer route than that of the main lines of the New York Central and West Shore roads between these points. From Rochester to Buffalo will be filled either by purchasing existing lines covering portions of this distance or by electrifying the branch of the New York Central from Rochester to Niagara Falls and Buffalo. Mr. Andrews states that this point has not been decided upon. Mr. Andrews also denies that the Central interests have obtained control of the International Traction Company, of Buffalo, with its suburban lines, as has been stated in press reports. It is understood also, from the best of authority, that the negotiations of the New York Central and Delaware & Hudson roads for a joint ownership of the Schenectady Railway Company's system will be consummated in the near future. This would give the syndicate lines connecting Schenectady with Saratoga, Troy and Albany, and an entrance to Albany, which is important. From Albany south to Hudson is the Albany & Hudson third-rail line, which is controlled by A. M. Young, of New York, who is associated with Mr. Andrews in other properties. Thus it will be seen that the Central's plans for a trans-State electric line are well advanced.

As to the present plans for operation, the present line from Little Falls to Utica will be utilized for the through line, and the through electric cars will then take the tracks of the West Shore to Syracuse, and the Auburn branch from Syracuse to Rochester. The system to be used in the electrification of the steam lines has not been decided upon, and there are many points to be considered before it can be settled. At the present time engineers of both the Westinghouse and General Electric Companies are at work on the problem. It has been practically decided that the steam tracks will not be equipped with overhead trolley, because it is the intention to continue the use of steam locomotives for freight traffic, and it is pointed out that the trolley would endanger the lives of brakemen on the tops of cars. It is also claimed that the sulphuric fumes from the locomotives would injure, if not destroy, the overhead line. A form of side contact trolley is being considered, as is also the third-rail system. The advantages of the alternating-current system of motors and transmission are being considered on account of the superior economies claimed for it, but it is feared that the adoption of this system might render it difficult to enter cities. Both tracks of the West Shore are to be equipped, and the short-haul passenger and package express will be taken care of on the electric division of the system, leaving the four tracks of the New York Central for fast passenger and freight traffic.

The financial end of the scheme will provide for the consolidation of the three existing traction properties into a single company, or it is possible that one of the companies may absorb the others. The new company will operate its own property and will utilize the tracks of the West Shore under a traffic arrangement. What the capital of the new company will be has not been determined.

The Guanajuato, Mexico, Power Transmission.—III.

BY ROBERT MCF. DOBLE.

(*Concluded.*)

TRANSMISSION LINE.

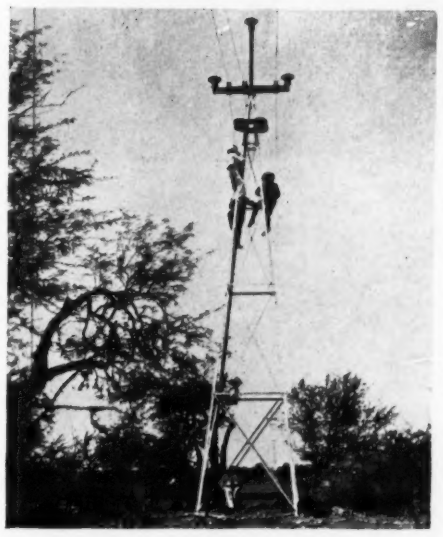


FIG. 33.—WORKING ON THE LINE.

THE 100-mile, 60,000-volt transmission line differs materially in design from any line heretofore constructed, notably in the use of a hard-drawn copper cable instead of the usual solid conductor, metal pins, cross arms and towers for supporting the insulators, and unusually long spans. From the power-generating station near Zamora the line passes for about 30 miles over rough mountainous lava formation cut by deep ravines. Near Guanajuato there also is some rough country, but for about 60 miles the line passes over clear, rolling country, the most of which is under cultivation.

The conductors are 19-strand, hard-drawn copper cables approximately ⅜ of an inch in diameter, equivalent in carrying capacity to a No. 1 B. & S. G. wire and weighing 1,340 pounds per mile. This type of conductor was finally determined upon, after much study and many tests, because of its high conductivity, flexibility and mechanical strength; the wires composing it having a tensile strength of over 55,000 pounds per sq. in. The cable was made and shipped in lengths of about two miles. The joints were made with special copper tube connectors 12 in. long and elliptical in cross section. The two ends to be joined were passed through the connector in opposite directions and three complete twists were given by means of special wrenches. The engravings show the making of a joint. No soldering was done. The cables are placed in grooves on top of the insulators, 78 in. apart, at the points of an equilateral triangle, and are tied in with No. 14 soft-copper wire, it being considered that the small wire wrapped about several times would make an easy tie and not be apt to damage the small, hard-drawn strands of the cable.

FIG. 34.—CEMENTING TOGETHER INSULATOR PARTS.

In stringing, the cables were pulled over the cross arms on rollers. The cable was shipped on reels in lengths of about two miles.

Where the topography and roads permitted, six of the reels were delivered from the wagons each four miles. The cables then were pulled out, spliced and tied in. In the mountainous sections the cable had to be cut into shorter lengths. Diagrams showing the proper sag to be allowed at various temperatures and for spans up to 1,320 ft., were prepared, based on a maximum strain of 20,000 pounds per sq. in., in the coldest weather and with the most severe wind. The calculations include an allowance for the mechanical elasticity of the cable.

The Locke insulators are larger, heavier and better than any heretofore used, and were required to stand a test potential of 120,000 volts for five minutes. They are over 12 in. in height and 14 in. in diameter and weigh about 15 pounds. They are made of porcelain with a brown glaze and consist of four parts. The top and the first

FIG. 35.—DISTRIBUTING INSULATORS ALONG THE LINE.

petticoat were glazed together in the kiln and the other two joints were made with neat Portland cement. The pins were likewise secured into the completed insulator, as shown by cross-section drawing of the pin and insulator.

The pins are of cast iron, conical in shape and cored hollow. The pin which carries the top insulator has an enlarged base, threaded on the inside, and is screwed on to the end of the 3½-in. extra heavy

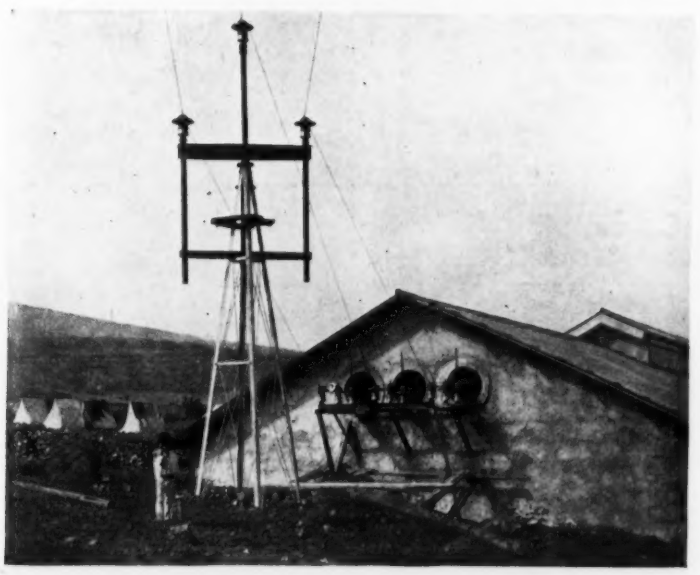
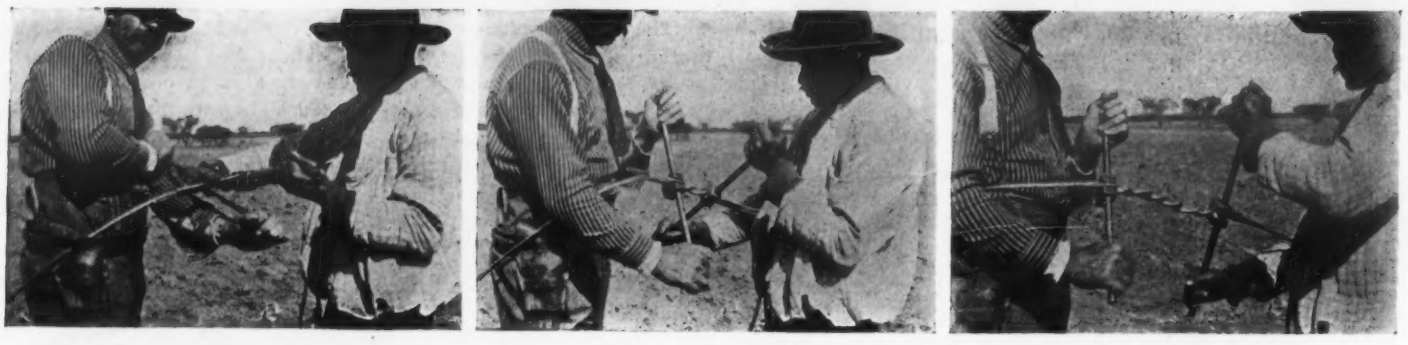


FIG. 36.—THE FIRST TOWER OF THE TRANSMISSION LINE.

pipe, which projects from the top of the tower. The pins which carry the lower insulators have rectangular bases, which are securely clamped between the ends of the 4-in. channels, which constitute the cross arm, as shown in the sketch of the top of the tower.

The insulators were shipped in two parts, in barrels, and the cementing together of the parts and the cementing in of the pins had to be done in the field. After the parts were assembled the "field" was covered with the packing straw from the barrels in order to protect the insulators from the hot sun while the cement was hardening. The completed insulators with the pins in place were then carried out from the construction camps to the required location on



READY TO TWIST. TWISTING. SPLICE COMPLETED.

FIG. 37.—MAKING A SPLICE IN THE CABLE.

the line, two at a time, by "man power" as shown. This was found to be the most satisfactory and economical method, as human labor is very cheap in Mexico.

The towers are special 40-ft., four-post galvanized steel structures, weighing about 1,500 pounds, made of 3-in. x 3-in. x 3/16-in. angles, braced and stayed with smaller angles and rods. Each post terminates in an anchor consisting of a piece of angle iron 30 in. long secured at right angles. The construction is clearly shown in the photographs. A 40-ft. tower with the 3½-in. extra heavy pipe fixed in position at the apex was built for testing at the factory of the Aermotor Company. This tower was bolted in its assembled state to the 30-in. wall of a five-story brick building, so that its axis was horizontal instead of vertical, as normally; a rope sling was attached to the pipe 70 in. above the apex of the tower and to this a wooden platform was attached. Weighed masses of pig iron were then placed upon this platform and the deflections of pipe and tower noted. When the load amounted to 900 pounds the pipe began to show signs of yielding; the tower, however, was perfectly rigid. When the load was 1,234 pounds the deflection of the pipe from a straight line amounted to about 6 in. On removing the load a permanent deflection of about 1 in. was found. The load was replaced and increased about 70 pounds at a time. With each increase the pipe took an additional permanent set, and at a load of 1,560 pounds it continued to bend until the load rested on the floor.

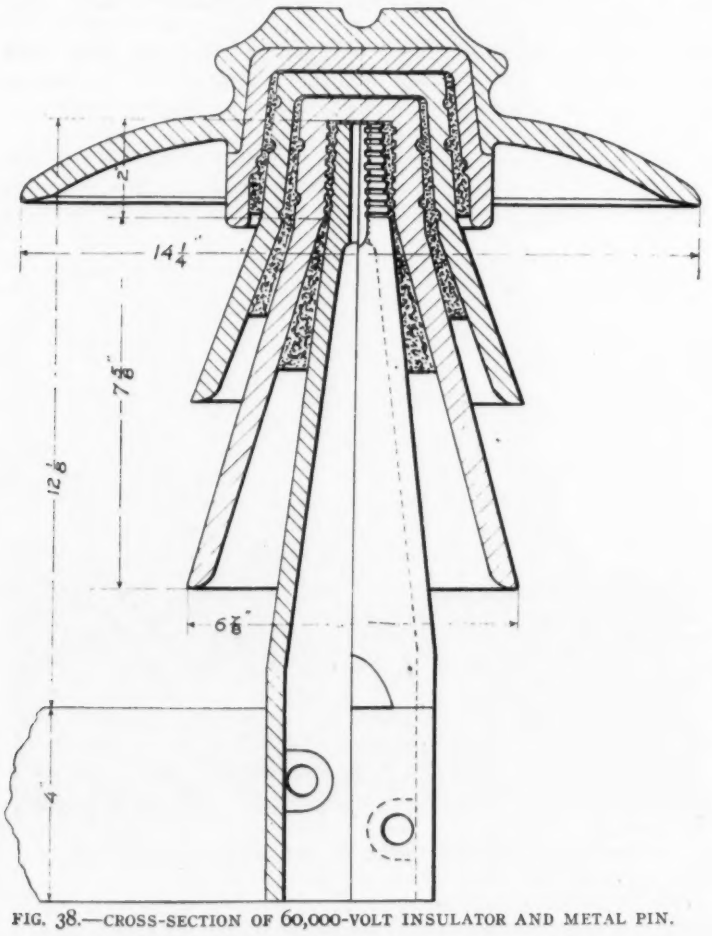


FIG. 38.—CROSS-SECTION OF 60,000-VOLT INSULATOR AND METAL PIN.

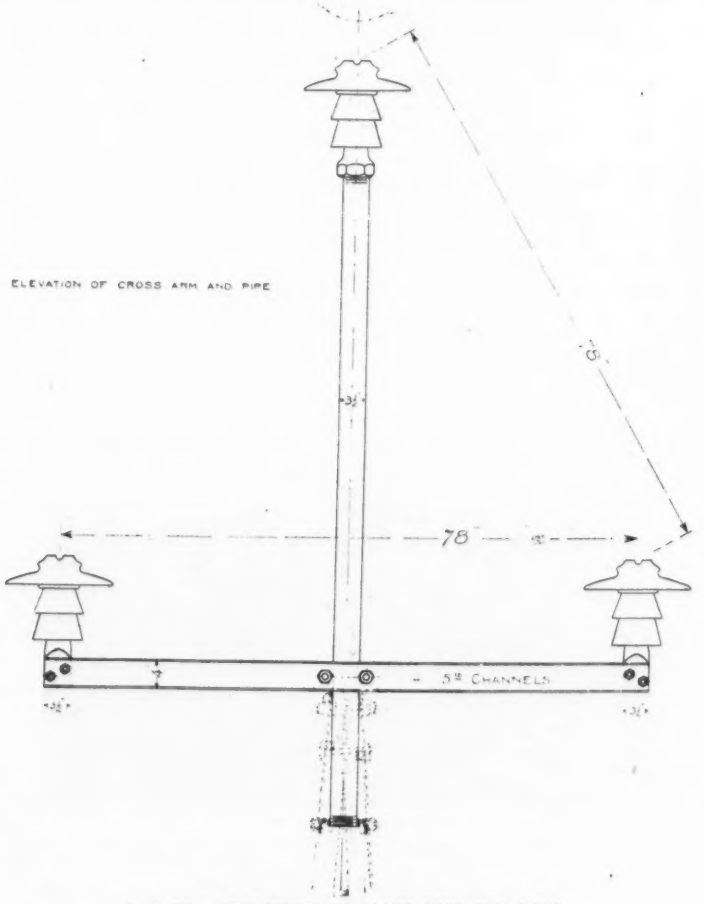


FIG. 39.—ELEVATION OF CROSS-ARM AND PIPE.

The all-metal construction of the supports for the transmission line was determined upon only after very thorough study and analysis and with a full realization of the fact that the insulators must then be of the most reliable and ample construction. The quality and suitability of the insulators were, therefore, carefully looked after.

The advantages of long spans, with consequent reduction in number of supports and of insulators required were so obvious that it was at once decided to adopt that type of construction. After careful study and many calculations and estimates the 40-ft. towers spaced twelve to the mile were determined upon. The towers are spaced 440 ft. apart, twelve per mile, except near Guanajuato, where the nature of the ground necessitated the use of a few 60-ft. towers and spans up to 1,320 ft. in length.

The No. 9 B. B. double galvanized-iron wires for a telephone circuit are fastened on the transmission towers 10 ft. below the copper power cables. They are tied to regular glass insulators placed on 12-in. painted oak brackets bolted to tower legs. The telephone wires are transposed one complete revolution every four towers; the power cables are not transposed. High-resistance instruments are used, and the telephone service is quite satisfactory. The climatic conditions for high-voltage transmission are usually good and during the dry season when the water is lowest, and when all the losses should be kept at a minimum, the atmospheric conditions are very favorable.

The long line of shining galvanized steel towers catches the eye of

the traveler as the train nears Palo Verde on the Guadalajara branch of the Mexican Central Railroad, or on approaching Irapuato on the main line from the north, at which points the transmission line crosses the railroad. It is almost straight, there being only a few slight horizontal angles. The line is divided into four sections of about 25 miles and is in charge of a superintendent whose head-

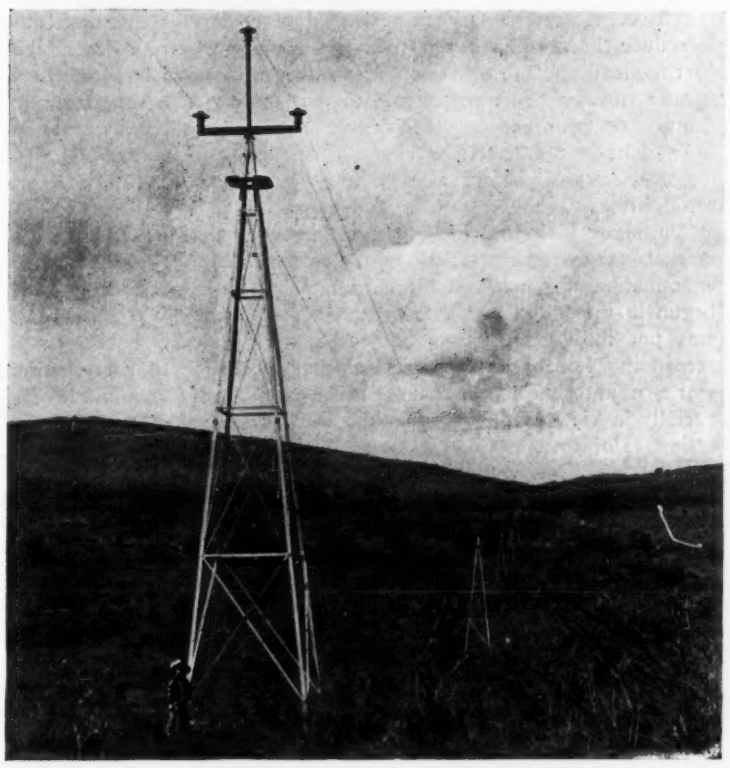


FIG. 40.—TRANSMISSION TOWERS ERECTED AND CABLES STRUNG.

quarters are at the middle storehouse. At each of the three division points there is a first-class storehouse, a set of 60,000-volt disconnecting switches in the main line, a line foreman and patrolman, both mounted. In the middle of each section there is a second-class storehouse in the care of a mounted patrolman.

THE SUB-STATIONS.

At Guanajuato the transmission line cables enter the sub-station through a set of 60,000-volt disconnecting switches, the same as at

FIG. 41.—ASSEMBLING A TOWER.

the generating station. The Guanajuato sub-station is a handsome stone building with brick trimmings and a flat roof, standing in a beautiful grove of trees. The dimensions of the building are: length, 113 ft.; width, 89 ft. There is a central portion two stories high with well-proportioned one-story wings on either side. One wing contains an office for the general manager, a drafting room, an accounting room and a reception room. The other wing is fitted up for a repair shop and storeroom. The central portion contains the transformers. A 10-ton, hand-operated crane runs over the shop and transformer room, passing through folding iron doors.

The current enters the building, passes a set of lightning arresters with disconnecting switches, like those at the generating station, and goes to a bank of oil-insulated, water-cooled transformers, where the line potential is reduced to 15,000 volts. These transformers are rated at 970 kw each. Their efficiencies as determined by factory test are as follows: Full-load, 98.193 per cent.; three-fourths load, 97.93 per cent. From the step-down transformers the cables pass through ducts under the floor to the switchboard, thence to the six 15,000-volt, three-phase distributing circuits, each of which is equipped with lightning arresters, and air-break switches with tube fuses.

The solid copper wires of the distributing circuits are carried on 5¼-in. brown porcelain insulators, supported on wooden pins in wooden cross arms on square yellow pine poles, 30 to 35 ft. in height, 9 in. by 9 in. at the butt and 7 in. by 7 in. at the top. The iron telephone wires are carried on the same poles, but are frequently transposed. The power wires are not transposed.

FIG. 42.—NEAR VIEW OF TRANSMISSION LINE.

At the mines and mills, where the electric power is used, the potential is reduced in three-phase transformers from 15,000 volts to 460 volts for motor service. The Guanajuato city two-phase, 2,100-volt lighting system is supplied through a bank of 150-kw, three-phase to two-phase transformers, with a feeder regulator in each phase.

A branch line extends to Irapuato, the "Strawberry Station" on the Mexican Central Railway. The Irapuato sub-station is a brick building equipped with 60,000-volt disconnecting switches and lightning arresters and the following oil-insulated, air-cooled transformers: Four 200-kw line potential to 15,000 volts; four 75-kw, 15,000

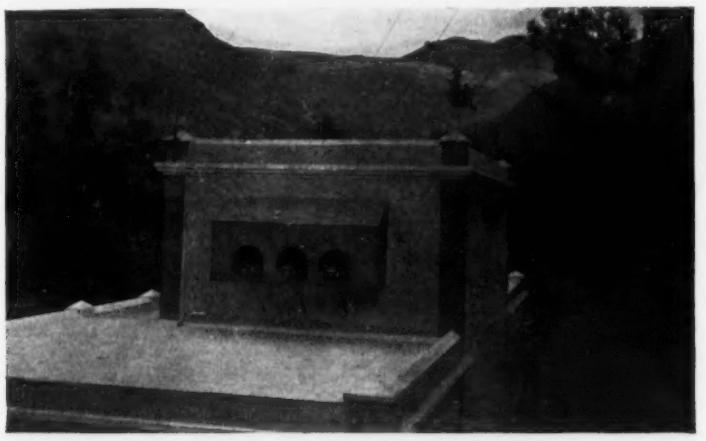


FIG. 43.—TRANSMISSION CABLES ENTERING GUANAJUATO SUB-STATION.

to 460 volts, for motor service; two 40-kw, 15,000 to 2,200 volts, for the city lighting system. Power is supplied to various small industries throughout the city, including three grist mills, a foundry, a wagon works, a paint factory and various pumps used in irrigating the strawberry fields.

MISCELLANEOUS NOTES.

To the ingenuity of the American engineers, backed by American capital, is due this noteworthy development by which the energy of the swift and boisterous Duero River has at last been harnessed, and after conversion into electricity has been transmitted over the 100

miles of intervening country to revivify the mining and other industries of the picturesque old city of Guanajuato, famous for its great mines, which are said to have produced, during the past 350 years, about one-fifth of all the silver in the world. Of late years these mines have not been worked to any great extent, largely because of the high cost of power.

There were many interesting as well as difficult features connected with the construction work. The task of hauling to the construction camp was by no means easy, although the distance was not more than ten miles. The way lay through the city of Zamora, thence to the little town of Jacona and thence about six miles along the State highway to the construction camp at the little Indian village of El Platanal, where the power-generating station is located. American

FIG. 44.—FRONT VIEW OF GUANAJUATO SUB-STATION.

mules were purchased and specially-designed American wagons were provided in order that adequate means should be at hand for carrying the heavy parts to their places.

The roads through the country are mostly over black adobe soil of indefinite depth. A few rainy days are sufficient to convert such roads into regular quagmires and put a stop to even such primitive means of transportation as are available in this locality. The haul through Zamora and Jacona was by far the worst part, since the streets had been "improved" by a pavement of stones of no small diameter; and in spite of the wide tires the wagons would break through the pavement into the underlying mud during the

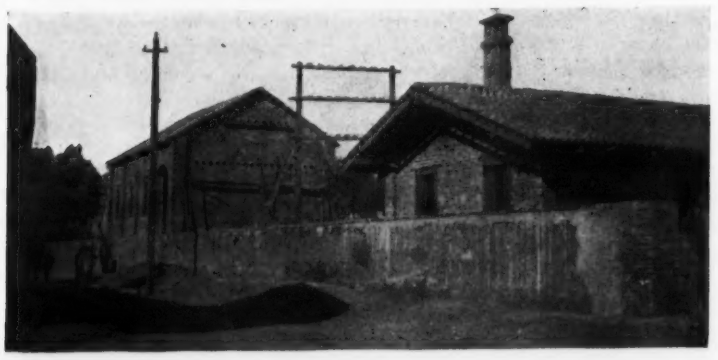


FIG. 45.—THE IRAPUATO SUB-STATION.

short intervals of time allowed for the animals to rest. It required a team of twenty-one mules to haul the lower half of the armature of one of the generators weighing 20,000 pounds. To get this load safely over the city streets required the combined efforts of two American superintendents and ten peons, all directly interested in some way in the moving of the load. Two wagons followed carrying jacks, block and tackle and tools for making repairs en route, forming in all quite a procession.

The handling and hauling of the pipe sections, weighing from 7,000 to 12,000 pounds each, a total of about 600 tons, was expeditiously completed, as shown. It is to the credit of the transportation organization that all of the hauling was done without the loss of or damage to a single piece of apparatus.

Carrying out a project of this magnitude in Mexico is made doubly difficult by the dense ignorance and absolute carelessness of the laboring class. The laborers, or peons, are mostly Indians or half-breeds, except where they are specially imported. These people wear as little clothing as possible, eat and drink whatever comes to hand, smoke cigarettes incessantly, are always ready to talk or play and are never ready to work. From time immemorable they have carried things on their backs, and it becomes necessary for the American to adapt himself to their ideas in order to get work done. It is exceedingly difficult, if not impossible, to teach them new methods of working. The customary method of handling dirt is by means of baskets or costals (a small piece of burlap) carried on the back. It is reported that when one contractor attempted to introduce the use of wheelbarrows, the peons preferred to carry the barrow, load and all, on their backs rather than learn how to wheel it on a runway. The wages paid to the laboring man vary from 40 cents to 60 cents per day (Mexican) if he be unskilled, 75 cents to $1.25 if he be a cabo (gang boss), and from $2.50 upward if he be a skilled artisan, and are unquestionably greater than he knows what to do with.

The short time in which this project was executed is most remarkable and is characteristic of the management. The preliminary examination was made in March and April, 1902, construction was begun in the fall of the same year, and in October, 1903, the plant was put into regular operation. This undoubtedly establishes a record in Mexico for rapid and efficient execution of construction work of a technical character and of considerable magnitude, especially in view of the fact that the work was completed within the estimates of cost.

Independent Telephony in Ohio.

The Ohio Independent Telephone Association met in Columbus recently and divided the State into nine districts and elected a vice-president as the head of each district. The plan is to have every telephone company in each district represented at district meetings where the general welfare of the independent campaign may be discussed and furthered. In accordance with these plans meetings of several of the districts have already been called. The first meeting will be held in Cleveland August 16, the second at Toledo on August 17 and the third at Lima on August 18. It is expected that many of the officers of the State association and the State executive committee will attend each of these district meetings. The object of the meetings will be to exchange ideas and adopt the best methods for furthering independent telephone development. An effort will be made to have the telephone companies buy only standard material and equipment. Every independent company in each district will be entitled to send a representative to these district meetings.

This plan is in line with steps which are being taken for the formation of a new national organization. At a meeting held in Chicago within the last week or two, composed of the manufacturers of telephone material throughout the country, plans for the organizing of a new telephone association to be brought about by the consolidation of the Independent Telephone Association of the United States and the Interstate Telephone Association, were discussed. A meeting is to be held in Chicago to which the officers and executive committees of the two associations have been invited, and it is expected at that meeting that the new organization will be formally launched. It is expected that the national association will be a representative body composed of delegates from the various State associations, which are now organized or will hereafter be organized. The State organizations will be represented by delegates from the district organizations as the movement has been started in Ohio. The plans provide that the local organization will have one representative to the State association for each 100 telephones, or each 100 miles of toll line or fraction thereof; district organizations to be entitled to one delegate to the State convention for each 10,000 telephones, or 10,000 miles of toll line, or fraction thereof.

No attempt will be made to consolidate the local exchanges or companies, the idea being that these companies should remain as they now are, separate and distinct organizations controlled by local people. They will be federated only in the sense that they will be working for a common cause and a common interest.

Among the long-distance companies, however, plans are being discussed for a closer union and it is predicted that a consolidation of the leading long-distance companies will be effected within a very few years. The various parties interested consider that the time is hardly ripe for the consolidation at the present time, because there is considerable development to be done by the larger companies to connect up the various systems, and it is thought that this should be accomplished before consolidations take place.

A Practical Test on Commutation.

BY ARTHUR KELLER.

THE object of the test described below is to enable one to judge the commutation of a finished machine, and especially by this means to determine the correct design of the pole tips. To understand the tests properly, it will be necessary to investigate briefly some commutation phenomena.*

Assuming the current is reversed by the contact resistance between brush and commutator only, the change of current in the short-circuited coil will be continuous (Fig. 1). Let J be the current in

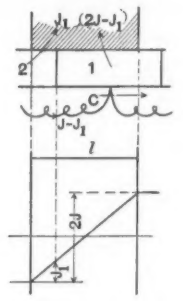


FIG. 1.—CURRENT IN SHORT-CIRCUITED COIL.

each side of the armature when the brush just covers the segment 1, then $2J$ amp. will flow from bar 1 to brush and J amp. will flow through the coil C. A moment later a current of say J_1 amp. will flow from bar 2 to brush, $(2J - J_1)$ amp. from 1 to brush and $(J - J_1)$ amp. through coil C. In other words, the currents flowing from bars to brush are at all times approximately proportional to the respective contact surfaces, the current in the short-circuited coil, C, changes at a constant rate from negative to positive maximum and the current density under the brush is constant everywhere and at all times.

But this change of current produces an e.m.f. of self-induction,

$$e = L \frac{di}{dt},$$

which is proportional to the coefficient of self-induction, L, and to the change of current in the time element, dt. L is practically constant, depending for its value upon the dimensions of the machine. If the change in current were constant, e would be constant also. This e.m.f. of self-induction, however, produces a local current of itself, so that the current in the short-circuited coil will not change continuously, but will assume, for instance, the form shown in Fig. 2. Self-induction in electricity is analogous to inertia in mechanics; inertia opposes any change in motion, likewise self-induction opposes

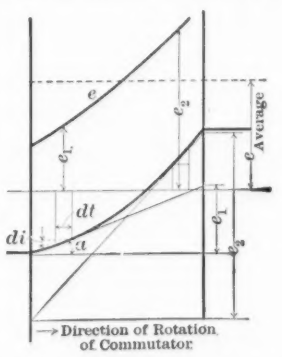


FIG. 2.—EFFECT OF INDUCTANCE OF COIL.

any change in current, and Fig. 2 shows a slower change in current due to the retarding effect of self-induction. The curve of the e.m.f. of self-induction, e, will no longer be a straight line, but its shape can be found by applying the formula

$$e = L \frac{di}{dt},$$

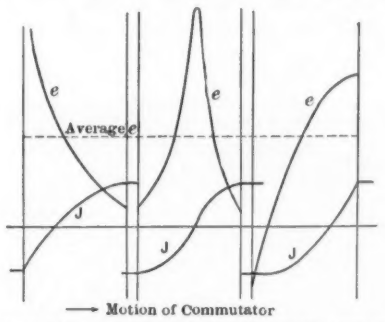
graphically as follows: Take any time element, dt, with the corresponding change of current, di, then

$$\frac{di}{dt} = \tan \alpha;$$

that is, the e.m.f. of self-induction will be proportional to e_1. Repeating this construction for several points of the current curve, the curve e is obtained. The curve shows that at the moment when the commutator bar leaves the brush, e is much larger than the average which would have been obtained for a straight line of the current. In a similar way the curve e is given; the current curve can be found in reversing the same graphical method.

This current curve now enables one to judge the commutation. A curve as shown in Fig. 2 would show that the current does not change rapidly enough, on account of the retarding effect of the self-induction. Then in the last part of the commutation the current must increase rapidly in order to reach its full value by the time the short-circuited coil is leaving the brush. The commutation in this case can be improved by moving the brush into such a field that the induced e.m.f. approximately counterbalances the e.m.f. of self-induction.

Other possible curves are shown in Figs. 3, 4 and 5. In Fig. 3 the short-circuited coil is moving in too dense a field, causing the cur-



FIGS. 3, 4 AND 5.—CURVES OF CURRENT AND E.M.F.

rent to reverse too rapidly. In Fig. 4 the coil is moving first in too weak a field and later on in one which is too strong. Such a case may happen with pole tips that have no bevels. In Fig. 5 the coil is moving in a field of the wrong sign.

As already pointed out, if the current density under the brush is constant everywhere and at all stages of the commutation, the current curve is a straight line; but for any other current density the curve will be different at different points and at different times. A local current will flow from the right bar to the brush, from there to the left bar and back through the coil to the right bar. This current, of course, does no useful work, but heats the brush and commutator. At the left side the current density under the brush is lower than on the right side, due to this local current, and, therefore, the voltage drop due to the ohmic resistance of the contact surface will also be lower on the left side than on the right. Plotting a curve of the voltage drops for the whole width of the brush, a curve is found which is approximately the same in shape as the curve e. Therefore, in measuring the drop at the brush, the current in the short-circuited coil can be fairly accurately determined.

In performing such a test the width of the brush is divided into any number of equal parts (Fig. 6) and the drop between any of

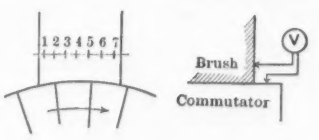


FIG. 6.—CONNECTIONS FOR TEST.

the marked points on the brush and the point exactly below on the commutator is found by means of a sensitive voltmeter. This test is made, of course, while the machine is running. The readings are plotted in a curve from which the current curve may be graphically determined as follows (see Fig. 7): Divide the curve of the voltage drop into a number of equal parts (4 parts in the figure), draw line II', connect I' with O, then $O\,I$ will be the first part of the current curve. Then draw $2\,2'$, $2'\,O$ and $I\,II$ parallel, $2'O$ and so on.

In Fig. 8 are plotted the results of tests on a 60-kw, 125-volt, 600-r.p.m. generator. The tests were made at very light loads. The brushes were set for best commutation under full load. If with full

*See also Arnold, The Direct-Current Machine.

load the commutation is ideal, so that the e.m.f. induced by the field approximately counterbalances the e.m.f. of self-induction, then evidently the commutation cannot be perfect for other loads with the same position of brushes, because the e.m.f. of self-induction

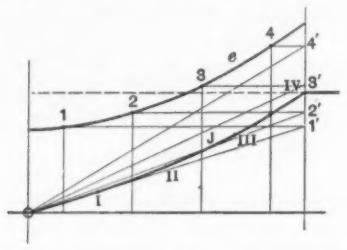


FIG. 7.—DETERMINATION OF CURRENT.

changes proportionately with the load, while the e.m.f. induced by the field varies only as the load current may shift the field. Therefore, for light loads the e.m.f. induced by the field will be stronger than the e.m.f. of self-induction, causing the current to reverse too rapidly. This is shown very clearly in Fig. 8. At 8 per cent. load there is a heavy over-commutation; the drop at one edge of the brush is positive and at the other edge negative. This of course

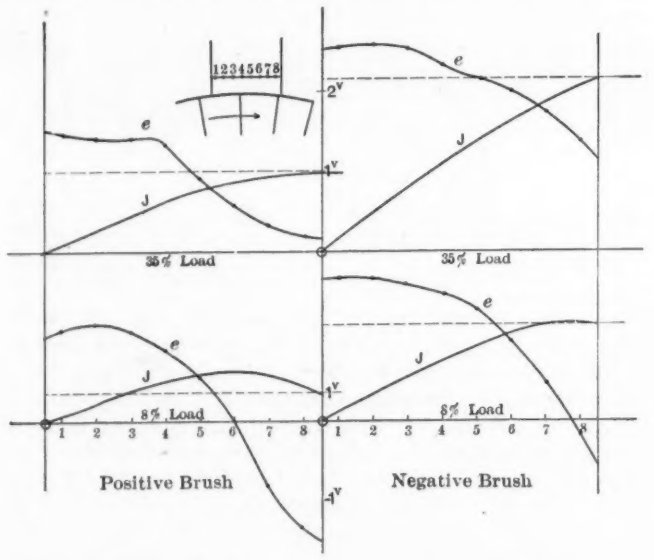


FIG. 8.—TESTS OF 60-KW GENERATOR, 600 R.P.M.

means a large local current flowing from bar to brush and back to bar. The voltages in all the curves are plotted to the same scale. For the current curves the scales can easily be found in each particular case. It should be noticed that the drop at the negative brush is in all the tests more than twice the drop at the positive. This is doubtless due to the relatively larger value of resistance scaled off on the negative brush, which affects but slightly the accuracy of the results.

It would seem that such tests have considerable practical value. The commutation can be judged by the current in the short-circuited coil, as the performance of a steam engine is judged by the indicator chart. If a machine sparks and it is ascertained that the sparking is not due to some mechanical imperfection of the commutator or brushes, then such a test may be made within a few minutes, and it may be possible to improve the commutation by making a slight change in the pole tips.

The current curve found by this method cannot be expected to represent accurately the phenomena taking place in the short-circuited coil, because several minor influences have been left out of consideration; but the results will be sufficiently exact for all practical purposes.

Wireless Message From Nome.

General Greely, chief signal offices, U. S. A., received on Aug. 9 the first telegraphic message sent direct from Nome, Alaska. It marks the inauguration of the Government wireless line from Nome, 107 miles, to St. Michaels. Gen. Greely said the receipt of the message indicated that the wireless line was working perfectly.

Röntgen Ray Work in San Francisco.

Mrs. Elizabeth Fleischman-Aschheim, who has devoted the past seven and one-half years to her work as a radiographer in San Francisco, has just demonstrated to her complete satisfaction that a screen of double plate glass is the most serviceable device for preventing injury to the operator. It can be applied equally well in radiotherapy and in radiography. This talented lady has had a great variety of experience in nearly every practical application of the X-ray and has taken about 3,000 radiographs. The subjects cover a wide range, including cases of fractures, gunshot wounds, impacted teeth, cancers, tumors, hip diseases, lung diseases and many others, which have come up in connection with the practice of the leading medical men of the Pacific coast.

After some experimenting, Mrs. Fleischman-Aschheim last April ordered the construction, according to her own plans, of a vertical plate glass screen, 2 ft. in width and reaching to a height of about 5½ ft. from the floor. During the past four months the screen has been in constant use in her laboratory and has been found so satisfactory that an announcement of the facts through the columns of the ELECTRICAL WORLD AND ENGINEER is considered timely.

As far as is known, Mrs. E. Fleischman-Aschheim, who is a member of the Röntgen Society of the United States, and has been recognized as the pioneer in a number of innovations in X-ray practice, is the first radiographer to make use of a glass screen in practical work of this kind. While operating she keeps the screen between her body and the tube whenever it is possible. Her exposed hand is protected by the usual rubber glove. She has found that the heavy plate glass screen possesses all of the advantages of lead plates in preventing the passage of the rays, with the very important addition of permitting an unobstructed view of the subject and of the X-ray tube in order to judge of the intensity of the rays.

It is well known that glass is opaque to the X-ray—in greater or less degree according to its thickness—but until very recently no one seems to have utilized that knowledge in practice. Metals, such a lead, aluminum, iron and copper, resist the rays to a great extent. Even the clothing has a slight protective effect, and rubber gloves are worn by many operators. Several small stands and devices, composed of lead plates or other opaque materials which diminish considerably the deleterious effects of the X-rays, have been on the market for some time. Mrs. E. Fleischman-Aschheim says that the lead plates cut off the view of the operator when handling the subjects and are not very practicable in other respects. A flexible mat, containing substances more or less impervious to the rays, can also be obtained of dealers, together with gloves of the same material. These have been found quite useful in her work, although limited in their range of application.

How to Amuse the Crowd.

A St. Louis Fair correspondent of the New York *Sun* says: "The crowd here is a sight-seeing one. It wants entertainment rather than instruction. This is illustrated every day in a thousand little ways. It is shown in the number of those who wander up and down the Pike, in audiences of 10,000 to 15,000, who watch the noisy display which purports to represent field engagements between Boers and British, but which is little other than a kind of Wild West show made very noisy with rifles, field batteries and rapid-fire guns. The usual procession is straggling along one of the aisles of the Electricity Building. It cares nothing for dynamos, and knows nothing of amperes or voltage. An English exhibitor, showing a monorail system of transportation, starts his little model on its circular track. At once there is a crowd. There is something to see. It is only a toy car running on a toy track; but it is something to see, and the crowd stops to watch. In the Machinery Building the crowd drifts along in indifference to tools and machines which are marvels of mechanical skill and ingenuity. But it stops to watch the man who saws puzzle blocks with a small machine saw. With clever skill he makes certain cuts in a small cube of wood. An assistant then takes it, pulls it to pieces, and behold, a toy set of furniture which, by proper rearrangement of its pieces, becomes again a cube of wood marked by the lines of the saw cuts. The crowd watches agape and buys the cubes for souvenirs. The crowd wants entertainment, and the amusements of the majority are no measure of the lasting benefits which come into many lives as a result of their visit to the Fair."

A Unique Storage Battery Installation.

BY HENRY FLOY.

IT is not so many years since the electric storage battery was usually installed in light and power work as an afterthought, to help out an overloaded engine, or to assist in maintaining the voltage at the end of a feeder which lacked in copper. At present we very frequently find the storage battery installed at the same time as the other apparatus, being included in the original design, as an important and essential part of the complete system. The reason for this change is due to the recognition of the most valuable function of the electric storage battery, namely, its ability to equalize the load and maintain constant voltage under fluctuating demands for power on the system.

Except in a relatively few and very especial instances, the storage battery is never used essentially in its storage capacity, its cost prohibiting that, but most generally as a regulating battery. The cost of installation and maintenance of a regulating battery will be found to be a reasonable percentage of the total cost of a plant designed to carry a varying load, and the benefits to be derived are as follows:

(*a*) A decided decrease in the capacity of the generating units required to take care of the same peak load, thereby decreasing the initial cost of the generating apparatus.

(*b*) The maintenance of a nearly constant voltage on the whole system, and in case of accident there is a small reserve capacity, instantly available—a consideration of value in most installations.

(*c*) A substantial reduction in the daily operating expenses. An engine carrying a widely varying load will yield only about one-half the efficiency of that same engine carrying a constant full load; consequently, if the fuel cost be taken at 60 per cent. of the total operating cost of the station, the installation of a storage battery, capable of maintaining constant full load on the engine, will result in a saving of from 20 per cent. to 30 per cent. in total operating expenses. In a station carrying widely fluctuating loads, there is no other single piece of apparatus that could be installed that would equal the storage battery in decreasing operating expenses.

It was the weighing of the above advantages that led the writer to recommend the installation of a storage battery in connection with an entirely new system* that was installed about three years ago at the then opened lead mines of the St. Louis Smelting & Refining Company, St. Francois, Mo.

A careful consideration of the various methods available for generating and distributing light and the different forms of power demanded throughout the several buildings above ground, along the miles of surface and mine trackage, down the shafts and through the levels of the mines, led to the conclusion that the best results could be accomplished through the installation of a 500-volt, direct-current electric system.

The electric generating installation consists of two 250-kw, 500-volt generators, each directly connected to a Corliss engine. The electrical energy is supplied as follows:

First, for a practically constant motor load, namely, the operation of pumps, machine and carpenter shops and numerous motors driving shafting or directly connected to individual machines in the mill.

Second, for a heavy fluctuating load, consisting of double-trolley locomotives, motor cars and mine hoists which lift net loads of 2,000 pounds at the rate of 1,000 ft. per minute.

Third, for a 250-volt lighting load supplied through a three-wire system having its neutral connected to the center of the storage battery.

As the fluctuating load exceeds at times the constant load, the advantage of a storage battery for maintaining a constant voltage on the system will be at once recognized, and incidentally it permits the use of single incandescent lamps from a 500-volt, three-wire system.

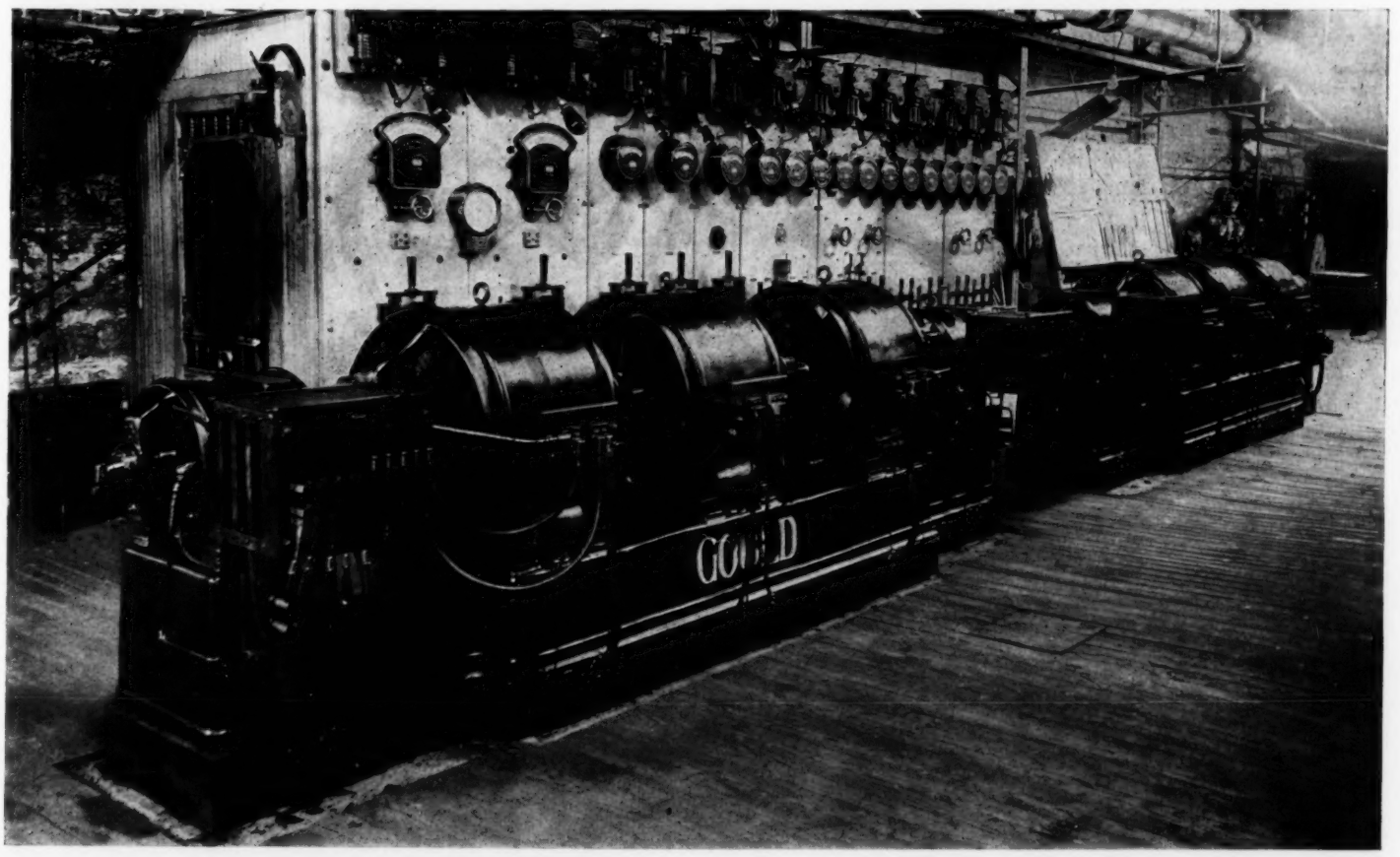


FIG. 1.—VIEW OF SWITCHBOARD AND BOOSTERS.

The original battery installation consisted of 250 15-plate, type F "Chloride" cells and two boosters, directly connected to a single motor. This battery had a capacity for regulating to the extent of about 400 amp. on a variable momentary load. The opening of new mine shafts by the Smelting Company and the continual growth of the fluctuating loads demanded an increase in the storage battery capacity.

The writer considered it most desirable to install a second battery and booster set complete, with a view to avoiding tying up the total capacity of the battery should an accident occur to a single booster, the Smelting Company having had such experiences; and he furthermore required that the two batteries and their boosters should not only be interchangeable, but also designed to operate in multiple. As far as known, no such plant was elsewhere in operation, it apparently being the accepted plan to abandon a constant-current

*Described in ELECTRICAL WORLD AND ENGINEER, Nov. 10, 1900.

booster wherever installed and purchase a new and larger machine in case it was found necessary to increase the capacity of the battery.

About a year ago a contract was entered into with the Gould Storage Battery Company providing for its furnishing a second battery and two new, identical, constant-current booster sets, one to take the place of that previously installed and the other set to be used in connection with the second battery.

In order to have the resistance of the two batteries identical, the cells were re-arranged, half of the old cells being connected in series with half of the new cells. (In Fig. 2 the "Gould" cells are shown in the foreground and the "Chloride" in the back.) Thus, each battery consists half of "Chloride" and half of "Gould" cells in series with a booster on each end, and the neutral of the lightning system connected in at the mid-point of the battery (see diagram).

The switchboard has two sets of bus-bars, one supplied by the generators, to which are connected the feeder circuits for the lights and constant-load motors. The second set of bus-bars, to which are connected the fluctuating load feeder circuits, is not connected with the main bus-bars except through the series booster; thus the current passing through the booster is supplied to either the fluctuating load bus-bars or the storage battery, depending upon whether the feeders supplying the fluctuating loads are demanding energy or not. In brief, the supply of constant current, if not consumed by the fluctuating load feeders, is absorbed by the storage batteries. A sudden demand for current by the fluctuating load will first draw on the supply being furnished by the constant-current boosters, up to that amount, and then the battery will begin to feed back into the variable-load bus-bars in multiple with the boosters, thus supplying the large momentary demand. (See Fig. 3.)

Ordinarily a motor and booster would compose a booster set, but in the installation considered the voltage is split in two by the neutral connected to the mid-point of the battery. As the lighting load will, from time to time in practice, be more or less unbalanced, it is necessary to be able to recharge either half of the storage battery independently. This requires, therefore, a booster for each half of the battery. The Gould system of booster regulation includes a separate and small machine, known as a "counter-electromotive-force" generator, which regulates the voltage of the booster instead of dependance being placed upon a differential winding for the booster field, as has been the usual practice. Thus the necessity for five machines in a set, as shown in Fig. 1, will be appreciated; the center machine being the motor, the two machines adjoining, one on either side, the boosters and the two small machines on the extreme ends being the c.e.m.f. generators. For the sake of simplicity, most of the switchboard connections are omitted in the diagram accompanying this article, but as a matter of fact the installation is so arranged that each booster set can supply its own battery independently of the other, either booster set can be used to supply the other's battery or both batteries at the same time; or both booster sets can be operated in multiple to supply either battery singly or both batteries in multiple.

After the installation as above was completed thorough tests were made of the different combinations mentioned, without any steadying resistance or other complication in circuit with the machines or batteries, and under light and heavy fluctuating loads (as high as 600 amp.) going off and on constantly. The result of all tests demonstrated the complete success and utmost flexibility of the installation, the voltage of the system remaining steady and the booster current reasonably constant.

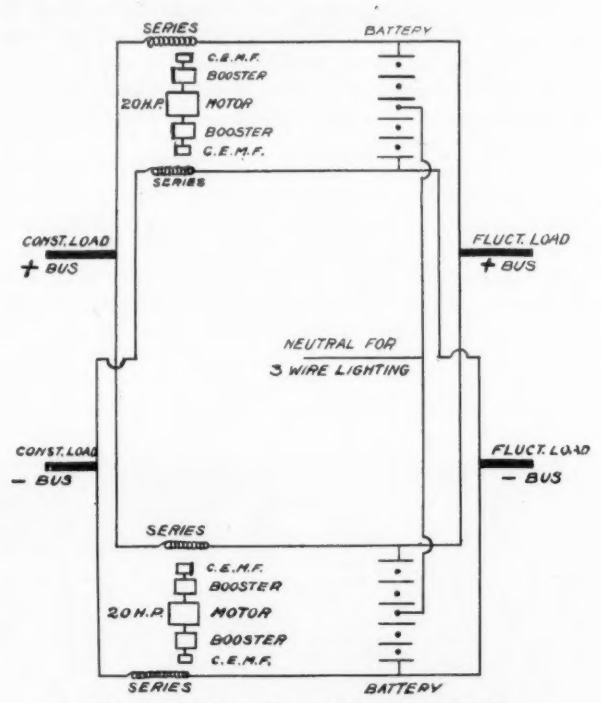


FIG. 3.—DIAGRAM OF CONNECTING CIRCUITS.

The plant has been in operation constantly for six months and I have yet to find the first cause of complaint with either the system or apparatus.

The success of the multiple operation of the batteries and boosters is no doubt very largely due to the particular features of the booster system, which make it peculiarly sensitive and quick to respond to changes in current and voltage.

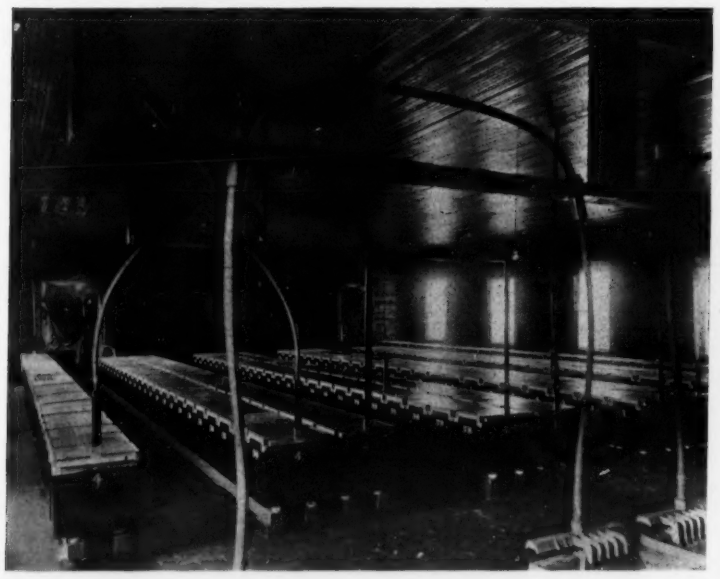


FIG. 2.—INTERIOR OF BATTERY ROOM.

FIG. 4.—INTERIOR OF BATTERY ROOM.

A noticeable comment on the advantage of the storage battery installation is the fact that during a large portion of the twenty-four hours' daily operation of the plant one generator and the two storage batteries will successfully carry the load, the engine operating at full capacity; whereas, with the storage batteries cut out of service, the two generators must be kept in operation, running part of the time at overload and much of the time underloaded in order to meet the varying demands of the fluctuating loads.

Economical Features of the Austin Telephone Company's All-Cable Plant, Austin, Minn.

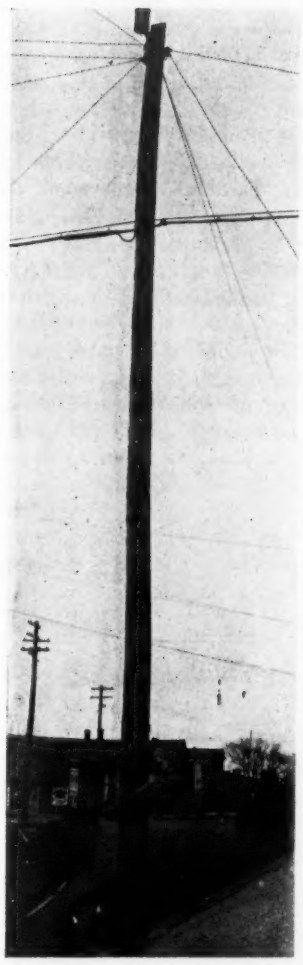


FIG. 1.—TELEPHONE POLE.

IN designing the all-cable plant at Austin, Minn., special attention was paid to each detail in the construction, with the view of eliminating as nearly as possible the chances for trouble, and thus reducing the cost of operation and maintenance to a minimum. The result is that this plant is probably the most economically operated one of its size in the world to-day. Owing to the substantial nature of the construction, the depreciation has been reduced decidedly below that of the average telephone plant, while the first cost is no greater than in any other system.

One of the most important features in the construction of this plant is the use of a great amount of cable, and the elimination of cross arms and bare wires. By means of an ingeniously designed terminal, connections are made direct from the cable at the pole nearest the subscriber to be served. This terminal connects to the main cable through a small, lead-covered cable known as the "tap cable." The number of wires available at each terminal depends partially upon the number of prospective subscribers to be supplied from this location. From this terminal, service wires lead to the subscribers.

Under the old method of distributing cables by terminating conductors at one point, it has been necessary to allow considerable margin for fluctuation. This is costly. Otherwise, small additional cables have to be installed in districts where unexpected growth takes place. This is not only expensive, but complicates the records. The fluctuation is taken care of in a properly-planned, multiple-tap cable system for each pair of wires, which may be utilized in a number of different places.

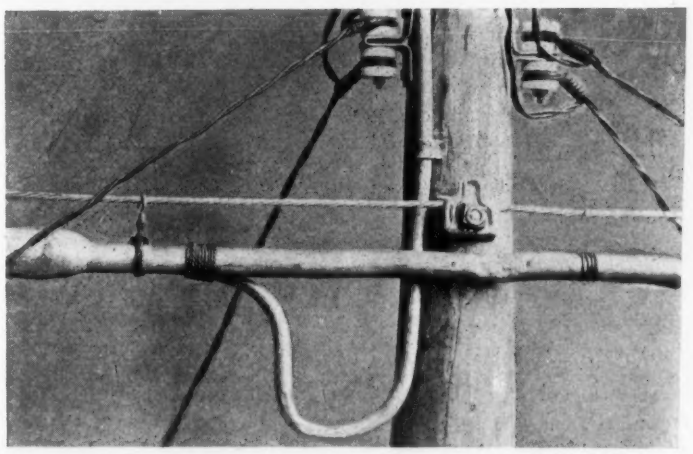


FIG. 2.—TELEPHONE CABLE AND POLE TERMINAL.

It is stated by Abbott in his recent book on "Telephone Cable Plants" that in the common method of cable distribution, from 25 to 50 per cent. of the cable pairs in the plants throughout the country are lying idle. This is due to improper planning of the cable system, and to the fact that the number of subscribers in a portion of the district supplied by a cable does not always develop to as great an extent as was anticipated by the person designing the cable layout; while in another district supplied by a portion of the same cable the development exceeds the capacity of the cable.

In planning the cable system of the Austin telephone plant, the ratio of fluctuation, or demand for service between large and small groups of subscribers, was kept in view. It has been determined in a number of operating exchanges that the fluctuation with small groups of subscribers is much greater than with larger groups.

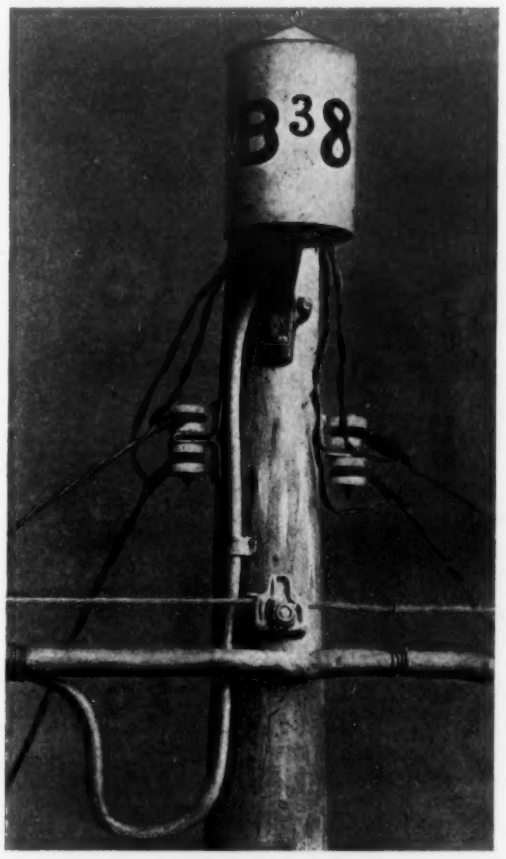


FIG. 3.—TELEPHONE CABLE TERMINAL.

Groups of ten lines often fluctuate as much as 25 per cent., while in large groups, with 75 to 100 subscribers, the fluctuation seldom exceeds 5 per cent. This principle was kept in view when planning the small groups for the individual terminals, and the large groups

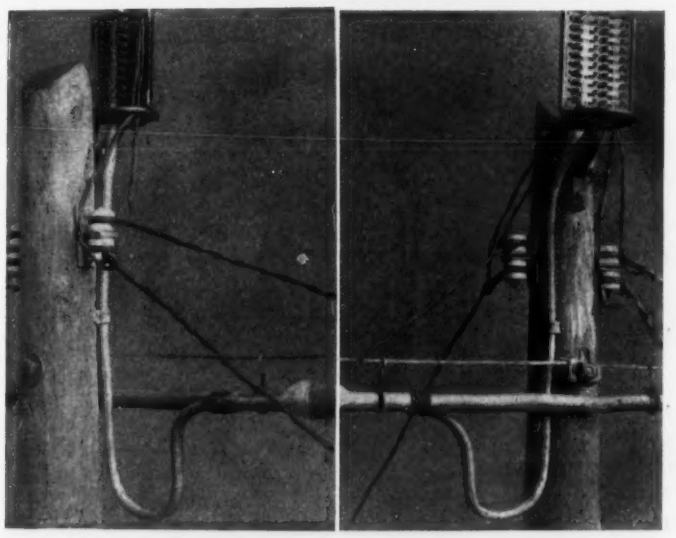


FIG. 4.—TELEPHONE LINE CABLE TERMINAL.

of branch cables making the main cable. A system planned in this way and properly multipled admits of a saving of at least 25 per cent. in cable conductors entering the central office.

One of the cables of 150 pairs in the Austin plant distributes to a portion of the city where the development reached a telephone for every seven inhabitants. In this cable 99.4 per cent. of the pairs were used and not a subscriber in the entire territory which it covers asked for service who was not supplied without delay, a result almost impossible to be attained by the old method of construction

and distribution. The plant was planned so that it was possible to increase the capacity 30 per cent. in this overloaded district, at an expense less than one-sixth of that usually incurred in making similar increase in capacity where ordinary style of construction is used. All that was required to accomplish this result was to erect an additional cable from the office to one of the multiple junctions. This relieved the congested district covered by this entire cable, some portions of which were three-quarters of a mile from the office.

Where the multiple-tap cable system is properly planned, the arrangements for the additional increase is no more expensive in

FIG. 5.—TELEPHONE CABLE AND POLE LINE, AUSTIN, MINN.

first cost than if the system was not so planned. In the plant at Austin the cable has been extended to every part of the city. The length of the service or drop wire, which is the wire from the cable to the telephone, averages 147 ft. These statements will give some idea of the great amount of cable used in this system. At first thought cable construction will appear to be much more expensive in first cost, but as a matter of fact it is not.

In open-wire construction each wire has to be sufficiently large to support its own weight. In the cable system a much smaller and lighter wire can be used, owing to the fact that the cable is supported by a steel messenger or strand. A mile of bare copper wire, of the size commonly used in outside construction, is 60 per cent. more expensive than a mile of No. 22 gauge copper wire, insulated with double paper wrapping, and formed up in a 100-pair, lead-covered cable.

It is also a fact that a mile of the No. 12 galvanized-iron wire is more expensive than a mile of copper wire in cable, as above cited. Another feature of economy in cable construction is the fact that it is less expensive to put cables in place than it is to string open wire on cross arms. The cost of labor in stringing a circuit mile of bare wire on cross arms ranges from a minimum of $7 to a maximum of $30, while the proportionate cost of erecting and splicing one pair of wires in a one-hundred-pair cable is less than $2 per circuit mile.

Another economical feature of this system is embodied in the fact that cross arms, braces, insulators, etc., are eliminated, and shorter and less expensive poles are made equally serviceable. The clearance of the cable over trees, or the height of the cable above the street, generally determine the height of the pole line. In the old system of construction 8 or 10 ft. of extra pole length is required above the cable on which to attach cross arms.

There are a number of other features which make this system very desirable. The cost of maintenance is reduced to a minimum, one man is able to look after several times as many 'phones, depreciation becomes a small factor, and the flexibility of the system is such as to take care of the constant shifting of the telephone population—a shifting which is noticeable in every telephone system. Another very strong feature is the ability to double the capacity for taking care of subscribers in any section of the city at a very small cost.

Where the old style of construction is employed, using cross arms, galvanized-iron and steel wire, terminal boxes, bridle wires, etc., the deterioration is such that the plant has to be rebuilt in a few years. In an all-cable plant, where the material is well selected and the workmanship is of a high order, the life of the plant should be several times greater than in a plant built after the ordinary style.

The poles used in the construction of the Austin plant were from A1 white cedar stock. They were thoroughly coated from the butt end to 6 in. above the ground line with a carbolenium compound for preserving the pole where it came in contact with the soil, thus lengthening the life of the pole many years. The messenger wire was of the best quality of double galvanized-steel strand, the size varying from ⅜ to ½ in., according to the size of the cable to be supported. The terminal, from which distribution was made, is of a substantial design and furnishes protection against both lightning and high-potential currents, and eliminates, to a great extent, all trouble usually met with in terminal heads (see Figs. 2, 3 and 4). From these terminals connections were made to the subscribers' 'phones by means of service or drop wires, which were of the best quality of rubber-covered, braided and twisted No. 14 hard-drawn copper. This class of wire, when properly put up, has a life of several years, and is considered by companies who have been using such wire for a number of years to be more satisfactory than bare wire. The expense of installing bare wire is almost twice as great as that of installing duplex, owing to the fact that it requires twice as many insulators and twice as much work to run two bare wires as to run one duplex. Special attention was paid to installing every part of the work in such a way that trouble would be eliminated as much as possible. An idea of the substantial construction of the cable lines and distributing circuits may be obtained from Figs. 1 and 5.

The central office equipment used in the Austin plant is of the common battery type manufactured by the North Electric Company, of Cleveland, Ohio. The board installed is of the full multiple type, and each cord circuit is equipped with indicating selective keys. Fig. 6 represents this key, which is an important factor in giving

FIG. 6.—INDICATING SELECTIVE KEY.

good party line service, as well as in making a saving of nearly 20 per cent. in operators' salaries over the use of a master key. Upon receiving a call, the operator replies in the ordinary way with an answering cord and listening key. After obtaining the number, say 526 L, she connects the subscribers as usual and depresses the L button. If the calling subscriber had called for 536 Y, she would have depressed the Y button. If he had called for 526 (an individual telephone), she would have pressed the button nearest the listening key, this button being wired for ringing the metallic or individual telephone. Upon ringing a subscriber, the button used remains slightly depressed for the time being, so that the upper surface of the button remains slightly below the level of the other buttons. By a glance at the keyboard an operator knows from the super-

visory lamps that a certain subscriber has not yet answered; she again presses the button, which is slightly depressed, and again rings the subscriber. This indicating feature is valuable in giving rapid and accurate service; otherwise the operator, after answering two or three other calls and noting by the supervisory that a subscriber had not answered, would be at a loss to know which one of the four parties on the line should be called (the line being a four-party line). After the conversation is completed and the operator wishes to use this pair of cords for another subscriber, by pressing another button, to signal another party, the former button depressed is released and the last button used remains depressed, indicating which party she had just called.

The selective equipment in the 'phones was worked out by Mr. L. W. Stanton, consulting and constructing telephone engineer, of Cleveland, Ohio, who also designed the multiple cable system used in this plant, and had charge of the installation of same.

The power plant consists of duplicate sets of charging machines of the special noiseless type, so designed that the storage batteries can be charged while the telephone system is being operated from them. The work of design and installation was so well done that the services of only one man are required for maintenance of the entire plant, which supplies nearly 600 'phones. Mr. Ernest G. Blaine, who is the manager and wire chief, is the only man in the company's employ to look after the central office equipment and telephones, and to locate and rectify all trouble. Crossed wires and outside construction trouble are almost unknown. Since the plant was installed it has passed through the winter months with some severe sleet storms, yet there have been but few cases of trouble.

The central office equipment was especially designed for economical maintenance. The power plant is equipped with underload and overload circuit-breakers and alarm contacts, making the system practically automatic, so that the attention of the wire chief is not required when the batteries are being charged.

The multiple cable feature of the plant has attracted a great deal of attention. A number of the leading telephone engineers and construction men from various parts of the country have looked over the system and have pronounced it a distinct advance in telephone engineering.

Attractions of Rural Life.

In discussing rural life, Mr. Wilson, Secretary of Agriculture, says: "The telegraph, the telephone and rural free delivery are giving great advantages to men who cultivate the soil, saving much time and enabling the farmer to accomplish much more in a given time than he could without these conveniences. The loneliness of farm life is also vanishing, and the attractiveness of farm life appealing to town people who are becoming interested in rural life, to the great gain of every neighborhood."

Experiments With High-Voltage Continuous Current.

The Compagnie de l'Industrie Electrique et Mécanique, of Geneva, Switzerland, has been conducting a series of tests to determine the relative ability of insulating materials to withstand continuous e.m.f. as compared with alternating e.m.f. During the tests, both continuous and alternating voltages as high as 70,000 were reached.

For the purpose of supplying the continuous current there were connected in series three dynamos, each capable of giving 1 amp. at from 20 to 25 kilovolts, the variation in e.m.f. being obtained by change in the exciting current, or by the use of one, two or three of the generators shown in Fig. 1. Alternating current at 50 cycles was obtained from a 75-kw machine, whose e.m.f. wave was flat-topped, its maximum being only 1.255 times the mean value. The rupturing value of the alternating e.m.f. for a given measured voltage was, therefore, much smaller than would have been the case had the e.m.f. wave been sinusoidal, and the test conditions were on this account somewhat favorable to the alternating voltage.

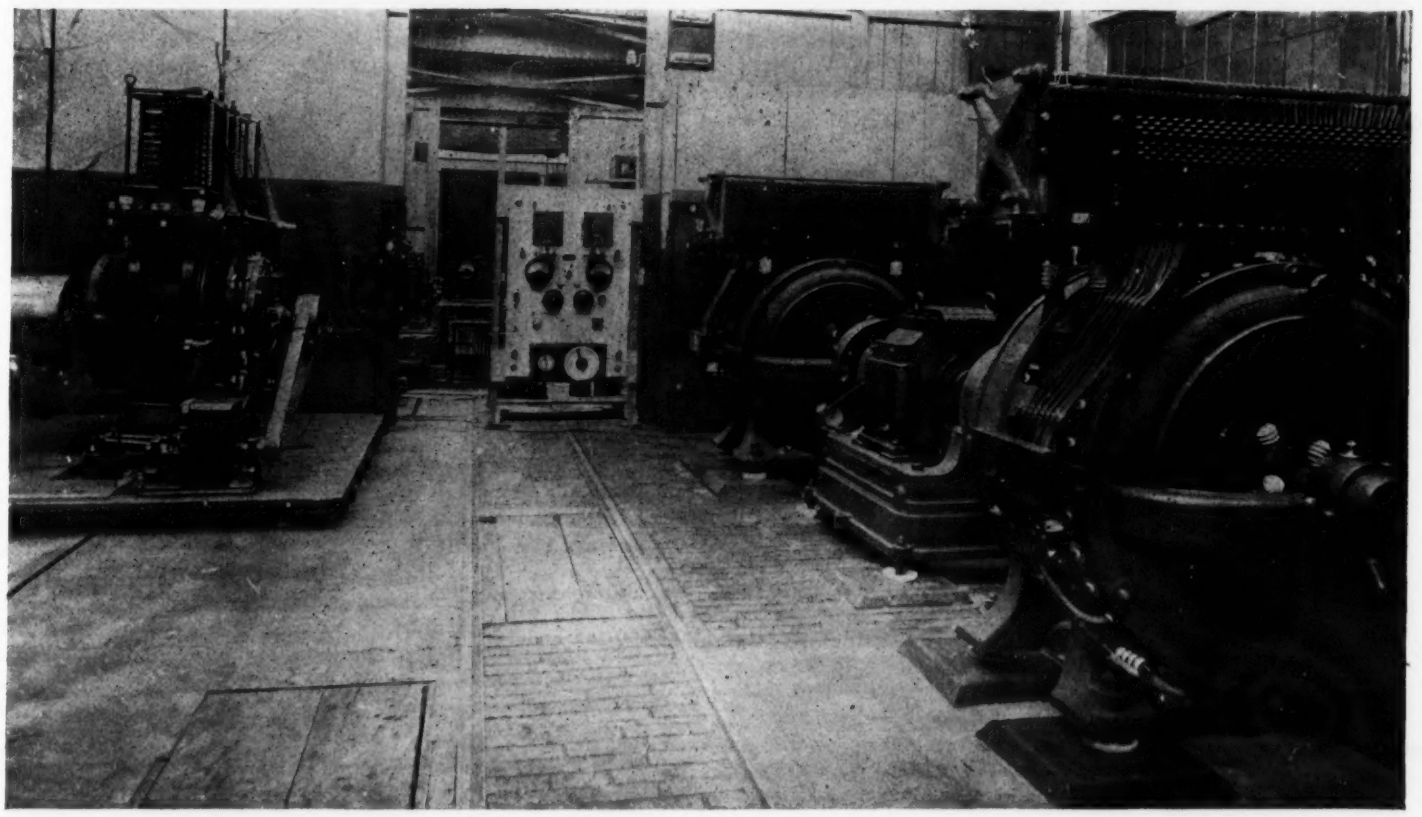


FIG. 1.—HIGH-VOLTAGE DYNAMOS.

As has been found true at lower voltages (25,000 volts) all insulating substances withstand much higher continuous e.m.f. than alternating. A significant fact in this connection is that the insulators heated considerably when subjected to alternating e.m.f., but almost not at all when continuous e.m.f. was used. This difference in behavior could doubtless be attributed to the fact that with alternating e.m.f. there is an appreciable dielectric hysteresis loss which is absent with the continuous e.m.f. Since insulators become much weakened when heated, and in fact become partial conductors when hot, it is to be expected that solid materials will withstand greater continuous than alternating e.m.f.

While doubtless a portion of the difference noted is due to the heating effect, as all tests with solids would indicate, when air was the dielectric, a somewhat similar difference was noted in the behavior of alternating and of continuous e.m.f. When a point and a dish were used as electrodes, polarity of the current was found to have marked influence upon the striking distance. Under certain adjustment of the electrodes, when the point was negative, 22 mm. was sufficient distance to withstand 40,000 volts, while when the point was made positive 40,000 volts required a separating distance

of 44 mm. At 60,000 volts 31 mm. was sufficient separation when the electrodes were balls and direct e.m.f. was used, while 74 mm. was required when the e.m.f. was alternating.

Tests made on a day of continued rain showed that, when wet, the insulators could withstand much greater continuous than alternating e.m.f. The following table gives the results of tests on five different types of insulators, which were subjected to break-down voltages first in the laboratory with alternating, and then when wet, with both alternating and continuous e.m.f.

BREAK DOWN TEST OF INSULATORS. E.M.F. IN KILOVOLTS.

Type.	Alternating Laboratory.	Wet.	Continuous Wet.
1	25	15	24
2	42	21	34
3	50	27	40
4	54	35	45
5	34	31	48

A number of materials subsequently tested gave similar results, all tending to show that insulators can withstand much greater direct than alternating e.m.f., the ratio being as 2 to 1 in almost all cases.

New Telephone Patents.

TELEPHONIC TRANSMISSION.

Two patents, granted to Isidor Kitsee, of Philadelphia, have appeared under the above title, both describing a system of improving the transmitting efficiency of telephone lines by the combined use of distributed capacity and inductance devices. In both systems the capacity is put in series with the sides of the line, while the inductance coils are bridged, with the additional modification in one system of using two coils to each pair of condensers and bridging them across the line directly at the condenser terminals. The inventor states that his system is the result of experiments which have conclusively proved its value. He does not, however, give any details or data of these or of the relations of line, capacity and inductance constants.

COMBINED USE OF LINES.

Another patent granted to Mr. Kitsee refers to the combined use of power lines for their normal and for telephone currents. He has particularly in mind such combination use of trolley wires, it being advisable to have a system by which it is possible to signal moving cars. To accomplish this the telephone apparatus for cars is attached to the trolley and run to earth in parallel with the motor. For the stationary stations the telephone apparatus is connected between the trolley line and earth. The telephone apparatus includes two inductive coils whose primaries are associated with a single transmitter and battery and whose secondaries are connected in parallel in a manner to produce currents exactly in phase. One end of the secondaries is connected to line, while the other connects to the receiver, and thence through a series of condensers to earth. The idea is to have the capacity in series with the receiver so small that, while sufficient to permit of the necessary telephone current, it will choke out the disturbing trolley currents. The accomplishment of this condition would seem at first sight very difficult, as the usual trolley induction (so-called) is of higher pitch than the average speaking tone of the human voice. It will, therefore, be interesting to see the actual development of the scheme.

TALKING-SET CIRCUIT.

A new circuit for common battery talking sets has been patented by W. M. Davis, of Chicago, the patent having been assigned to the Stromberg-Carlson Telephone Manufacturing Company. Fig. 1

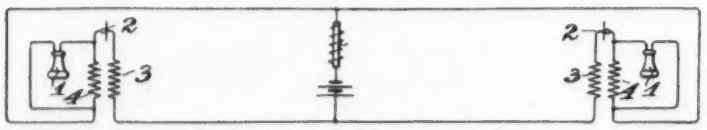


FIG. 1.—DAVIS TALKING-SET CIRCUIT.

shows a conventional diagram of two circuits, in connection. The induction coil to be used has a ratio of one to one, there being the same number of turns in both primary and secondary. The windings are connected up so that for currents generated by the transmitter the retarding effect of primary and secondary neutralize. For incoming currents a portion traverses the receiver, causing a direct effect, and there is an additional effect produced by the currents induced in the secondary by the primary. In the illustration, 1 is the receiver, 2 the transmitter, 3 the primary winding and 4 the secondary.

COVER CONNECTIONS.

For many years it has been customary to use cover hinges as a means through which to connect apparatus upon a telephone box cover with that within the box. At first trouble was experienced due to corrosion or other cause of poor connection at the hinge pin, but of recent years this has largely been obviated by the use of spiral springs, having their ends secured to the two leaves of the hinge, the spiral surrounding a part of the pin. Charles C. Hughes, of Baltimore, has tried to obviate altogether the use of the hinge by providing registering knife switch connections, the clips to travel with the box cover and the blades to be secured within the box. This may prove a very useful form of connection for some conditions.

SERVICE METERS.

Two patents for connection-recording devices have been granted to J. L. McQuarrie. One of the patents relates to a service meter, which is to be located at the subscriber's premises, it being necessary for him to record manually a call upon the demand of the operator.

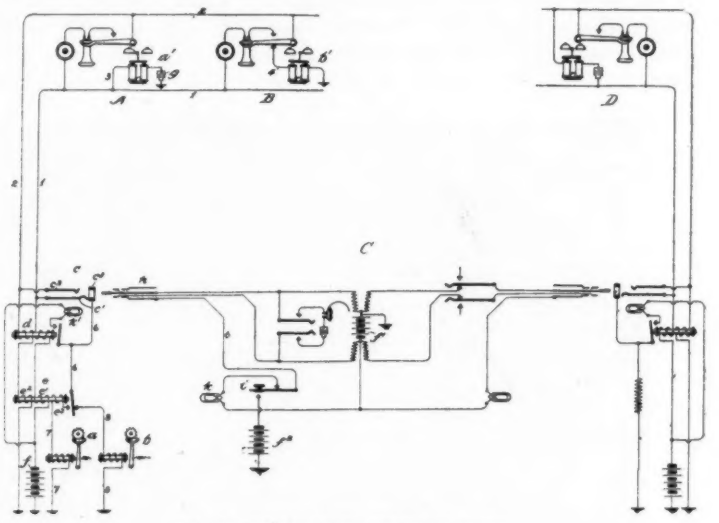


FIG. 2.—M'QUARRIE SERVICE METER.

The usual audible signal is made each time a count is made, to notify the operator of its accomplishment. The present invention, however, relates particularly to a second signal, which is operated electrically, and which may be set to indicate when a predetermined number of calls have been sent. For example, every hundredth call may be indicated to both subscriber and operator by not only the usual single stroke of the gong, but also by the sounding of a buzzer. A gear train associated with the counter push button and controlling contacts serves to actuate the buzzer on the proper call.

The second of these service meter patents provides a means of differentiating between the parties on a party line system in which the metering devices are at the central office and the record calls under the control of a key in the operator's cord circuit. The system requires special arrangement of the apparatus at the switchboard, the circuit being as shown in Fig. 2. Here *A* and *B* are two parties and *a* and *b* their toll meters. It will be noted that the condenser usually placed in the tap from the subscriber's call bell and ground is omitted at Station B. When a call comes in the line relay responds and lights the line lamp. At the same time the selecting relay, *e*, operates or fails according to which station has called. Windings e and e^2 of this relay are differentially connected. If Station A called the winding e^1 would receive an excess of current, for winding e^2 becomes shunted by the bell at Station B if the hook is up at Station A. This causes relay, *e*, to operate to connect and lock in meter *a*. If, on the other hand, *B* had called, there being a condenser in the ground tap at *A*, no disturbance of the equilibrium would result.

The dimming of the line signal and the proper operation of the supervisory signal depend upon the fact that each of these lamps shunts the other in series with the resistance of the meters. The meters themselves fail on this current, but they operate upon the excess current following direct connection to the battery by key *i* of the cord circuit. Mr. McQuarrie has assigned both his patents to the Western Electric Company.

BALANCING OF PARTY LINES.

Last week some description was given of a system patented by W. M. Davis for selectively calling six parties. There now appears

a patent for means to balance such a party line, when one or more of the stations are missing from one side of it. This means may be either a combination of condenser and retardation, equal in effect to a bell, which is wired in for each missing station; or it may be an adjustable retardation to be wired in at the central office and adjusted for balance. The later patent covers the use of such balancing devices in connection with the previously-described system. The patent has been assigned to the Stromberg-Carlson Company.

TELEPHONE EXCHANGE SYSTEM.

An entire system of operating for telephone exchanges has been devised by I. Kitsee. The switchboard comprises an elevated lampboard in the middle of the operating room, and operating tables of a semi-horizontal character arranged in several rows on each side. Each line has a lamp on the lampboard and one at its jack at the operating table. Conducting plates are arranged beneath each operating table, which serve as cord circuits. A series of pairs of plugs, each pair designed to register properly with one conducting plate and one only, is provided. The proper connection of subscribers, of course, depends upon the plugs always being used in proper pairs. Each plug carries in its handle a lamp which serves for a supervisory signal. The trunking and busy test arrangements are not disclosed in the present patent, but it would seem that the only function of the lampboard would be that of a visual busy device.

Recent Electrochemical Developments.

BATTERY INVENTION.

A patent recently granted to Thomas A. Edison refers to the manufacture of copper-oxide electrodes for primary batteries, especially of the Edison-Lalande type. The inventor treats precipitated hydroxide of copper with hypochlorite of sodium, thereby producing an excessively finely divided black oxide of copper, which is then dried, moistened with a solution of sodium, pressed into plates of the desired form and burned in the regular manner to consolidate the mass. Finally, a film of red oxide of copper is rubbed onto the surface of the electrode.

J. A. Lyons and E. C. Broadwell patent a new type of storage battery. The anode is a graphite plate surrounded by a mixture of carbonaceous material with the oxide, hydroxide or oxysalts of such metals as give two or more forms of oxides, like lead, nickel, cobalt or cerium. This in a pasty consistency is placed around the anode and the mass saturated with a solution of either a basic haloid of the oxysalt or its equivalents, of the metal, by the electrolysis of which deposition in reguline state occurs at the cathode. They recommend as the electrolytic salt, zinc oxychloride or zinc chloride or bromide holding zinc hydroxide or oxide. The function of the basicity of the salt lies in the neutralization of any acid generated at the anode during electrolytic action. The electrochemical reaction during discharge is the deposition of the metal (zinc) upon the cathode and the change of the anodic metal to a higher state of oxidation.

V. G. Apple patents a battery cell provided with an exterior insulating layer so as to form a unitary structure. Rubber and rubber compositions may be disadvantageously used, since when vulcanized to the metallic container such material will be so intimately attached to the metal as to be practically integral with it.

MISCELLANEOUS.

J. S. Zerbe patents apparatus for the purification of water by electrical means. The water first enters the lower end of an electrical chamber, which is provided with electrodes, and flowing upwardly through it, is then conveyed to the lower end of a filtering chamber, through which it also flows upwardly. At the same time provision is made by means of a pipe to convey ozone gas generated by the electrolytic action, or a portion of it, to the interior of the filtering cylinder, whereby the ozone is enabled to act on the water more efficiently than would otherwise be the case.

Thomas A. Edison patents improved apparatus for more expeditiously carrying into effect the process for depositing metals in vacuo. The apparatus is designed for the special purpose of depositing on phonograph records minutely thin films of vaporized metal which shall act as a foundation for the heavier electroplated deposit in order that a matrix or mould of such a record may be secured.

Steadiness of Incandescent Lamps.

In an article which appears in the latest *Bulletin* of the University of Wisconsin, Mr. Harold Seaman, in discussing the effect of frequency on the steadiness of light emitted from an incandescent lamp, describes a method involving the use of a selenium cell which seems to possess many advantages over other well-known photometric methods. A slotted disc was caused to rotate in such a manner that the rays of light from the lamp under test were intercepted except at different points on the current or light wave. The intensities of light were noted for these points by observing the resistance of a selenium cell upon which the light was caused to fall. Results obtained were sufficiently consistent among themselves to show that the method was capable of determining the variation of light emitted by the lamp throughout each cycle for all commercial frequencies and of investigating the magnitude of the flickering obtained with low-frequency currents. As has been held for sometime, an incandescent lamp operated on a current frequency of 60 cycles per second will give light nearly if not quite uniform, while at a frequency as low as 25 the light emitted from a high-efficiency, 16-cp incandescent lamp cannot be considered other than varying between comparatively wide limits and with a frequency equal to double that of the alternating current.

The thicker the filament, the smaller is the variation of temperature, and, therefore, of light from an incandescent lamp for a given change of instantaneous energy which varies throughout rapid cycles. The light from a high-efficiency, thin-filament lamp is more greatly affected by a given change of energy than that from a thick-filament lamp of the same candle-power. It is to be regretted that no tests were made to ascertain the effect of using low-voltage, low-efficiency lamps on low-frequency circuits, because a comparison of the flickering under such conditions with that obtained normally would prove instructive. Since persistence of vision and fatiguing of the optic nerves appear as such disturbing elements in many photometric tests of lamps, the purely electrical method of making observations should prove advantageous for investigations such as here noted.

Side-lights on Electrical History.

Many electrical engineers remember with pleasure their visit to Great Barrington, Mass., in 1902, during the Institute convention of that year. During the two first days of August just past, "Old Home Week" was observed, and New England hospitality once more attracted to the beautiful village many of the old residents who, with the town's people and visitors from neighboring villages, made the occasion one of unusual interest. Naturally, the minds of the homecomers turned to reminiscing, and when, in the course of the exercises, Chairman Collins called upon Mr. Ralph W. Pope, he naturally told the story of his early telegraphic days.

Mr. Pope first practiced the art of telegraphy in 1858 in Great Barrington, learning to operate the Hughes printer. In 1860, when he was 16 years of age, he had become a Morse operator and was manager of the Great Barrington office. This was at the outbreak of the Civil War. Up to that time the general news of the previous day did not reach Great Barrington until 2.35 p.m., when the New York papers arrived. The attack on Fort Sumter, however, led to a more prompt service by telegraphic bulletins, and at many places in the North the citizens clubbed together and paid the operator and the company for earlier reports. The receipts of news in this form was a new development, as "electricity was in its infancy." A feeling of skepticism prevailed, however, as to the reliability of the news thus purveyed, which finally took form in the outspoken remark of an old citizen, that "Ralph Pope would sit there all night and make up that stuff for a dollar and a half."

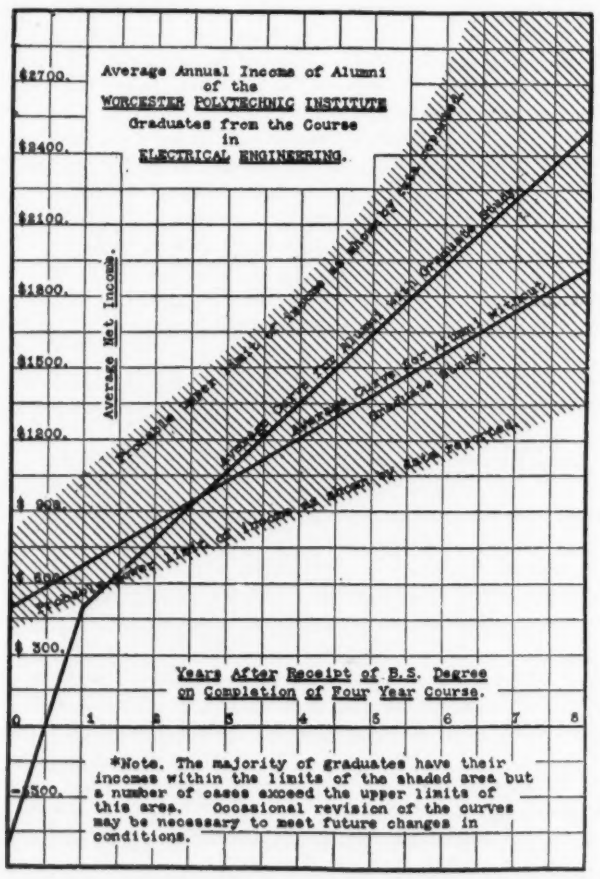
In those days the Berkshire Woolen Company had a large factory at Great Barrington, operating its looms with water power. The factory has since been abandoned, and the water power once used for making cloth now supplies electric light and energy for private and public uses.

The gas plant is deserted and its useless pipes rust in the soil. The humming trolley car traverses Main and Water Streets. The

present leading industry is the Stanley electric meter factory. The fine old country seat, "Brookside," is owned and occupied by that pioneer in electrical invention and development, Mr. William Stanley. Just out from the village one of the leading electrical engineers of the country, F. S. Pearson, has built a charming residence and will compete with Col. W. L. Brown, former editor of the *Daily News*, of New York, for distinction of being the greatest farmer in Southern Berkshire. There exists in Great Barrington also a colony of electrical engineers. Frederick Darlington, W. H. Browne, W. C. Andrews, E. H. Gough and many others, while only seven miles away Stephen D. Field, in his well-equipped Stockbridge laboratory, has already solved some of the greatest problems in multiplex telegraphy, which will soon assume practical form and add fresh laurels to the already recognized fame of his family. From a comparatively unknown town of fifty years ago, Great Barrington has by the mere improvement of railroad service seen its schedule time to New York reduced from six to three hours, it has become an important electrical center, and even the pure water of its farmers' springs is promoting the temperance movement, by its sale to the people of America's metropolis.

The Value of Technical Training.

While the basis of income which a man may be able to secure is, in many respects, a false standard of comparison as to real worth, yet it is perhaps as definite a measure of his monetary value to society as any single arbitrary method at our command. The accompanying diagram, which has recently been prepared from data received from graduates of the Worcester (Mass.) Polytechnic


Average Annual Income of Alumni of the WORCESTER POLYTECHNIC INSTITUTE Graduates from the Course in ELECTRICAL ENGINEERING.
$2700.
$2400.
$2100.
$1800.
$1500.
$1200.
$ 900.
$ 600.
$ 300.
-$300.
Average Net Income.
Years After Receipt of B.S. Degree on Completion of Four Year Course.
0 1 2 3 4 5 6 7 8
*Note. The majority of graduates have their incomes within the limits of the shaded area but a number of cases exceed the upper limits of this area. Occasional revision of the curves may be necessary to meet future changes in conditions.

INCOME DIAGRAM.

Institute in electrical engineering, and which will appear in the November number of the journal of the Institute, serves to emphasize the value of a thorough technical training and of post-graduate work.

This diagram is probably unique in that it shows most completely the financial prospects of technical graduates from year to year. As the Department of Electrical Engineering at the Worcester Polytechnic Institute has been established but eight years, there is data available for this period only, but during this time a large number of students have graduated, and data has been received from a sufficient number of them to represent conditions fairly. From these curves it is seen that the average graduate who receives $500 per year for his first position after leaving the Institute rapidly increases in value, so that at the end of eight years he may expect to receive an income of about $1,900; or, if he has been a graduate student at the Institute for one year, his income is shown to average about $2,500, which, capitalized at 5 per cent., gives him the income on an investment of about $50,000. By investing five years of his time and the cost of his college training, he has after a few years and for the remainder of his life increased his income earning value by not less than $40,000.

Results of Municipal Extravagance in England.

An interesting letter from the London correspondent of the New York *Evening Post* discusses the lower condition of the savings fund in England and the falling off in bank deposits. To the extraordinary growth in municipal expenditure is attributed a tremendous increase in the general national indebtedness, while the desperate means now resorted to for raising money by local authorities is thus depicted:

"Until quite recently the money required by corporations has been obtained through the process of public loans in the form of permanent stock. Less than ten years ago, for example, when money was a drug in the market, some of these corporations were able to borrow almost on a 2 per cent. basis, and there is no doubt that this excessive ease in money encouraged reckless extravagance with subsequent borrowing on the part of the corporations in question. Latterly it has been almost impossible to place such loans at all in the market except upon terms which the municipalities have considered harmful to their prestige. But municipal extravagance has continued in spite of the difficulty in obtaining the necessary cash, and in some cases the difficulties were tided over temporarily by large overdrafts from the corporations' bankers, and in others by placing privately large lines of two and three-year bonds with insurance companies at somewhat high rates of interest.

"But it is a third device to which these corporations have had resort which calls for special attention and goes far to explain the shrinkage in bankers' deposits. In many of the leading provincial newspapers, advertisements now appear stating boldly that the "—— corporation is prepared to receive deposits direct from the public, either for withdrawal at short notice or to be held for a fixed period.' In all cases the rate of interest offered is slightly above that given by the joint stock banks, while in many directions, and notably in Scotland, the advertisement frankly declares that interest will be given at ¼ (and sometimes ½) per cent. above that offered by any joint stock bank. Now your readers can easily imagine that while the public may be disinclined to purchase stocks at the present time, advertisements such as these appeal considerably to their interests.

"When I tell you that one corporation alone is believed to have secured about 5,000,000 sterling within a very short period by these means, I think you can readily see how bankers' deposits must have been affected, and how the savings of the country may be somewhat hidden. A little thought will also convince your readers that another aspect of this question is likely to present itself at a later period. What, for example, is going to happen when those who have deposited large sums with these corporations become convinced that investment stocks have reached the bottom level and that the time has come for reinvesting their money?"

Large Italian Wireless Station.

Details of the largest wireless station in the world to be erected at Pisa, Italy, are communicated to the Department of Commerce and Labor by Consul-General Guenther at Frankfort, Germany. The station will be called Coltano, and it is designed to establish wireless telegraphic communication from there with Great Britain, Holland, the United States and Canada, as also with vessels in the Mediterranean, the Baltic Sea, the Red Sea and the Atlantic and Indian Oceans. The buildings will be of the most approved style and will be constructed entirely of stone. As it will take some time to put the machinery and apparatus in place, the station will probably not be ready for receiving and transmitting messages before the beginning of next year. The Marconi system will be employed.

CURRENT NEWS AND NOTES.

THE ALASKAN CABLE.—The cable which the United States steamship *Burnside* has been laying from Sitka, Alaska, south, is completed to within 150 miles of Cape Flattery. The *Burnside* has returned to Seattle for 300 miles more of cable, enough to complete the line. Col. James Aller, who is in charge of the work, says that with favorable weather the cable can be finished in two days after the *Burnside* picks up the buoyed end.

A SIX-TRACK ELECTRIC ROAD.—In announcing plans for the improvement of the New York, New Haven & Hartford system, President Mellen states that the road intends to spend about $10,000,000 in making the Harlem River branch, running from New Rochelle to One Hundred and Twenty-ninth Street, a six-track rapid transit electric road. It is also reported that the company intends to build a $50,000 railroad station at New Rochelle in place of the present structure.

A CURIOUS STRIKE PROPOSED.—A cablegram has been received in Washington from Lieut. C. S. Owen, commanding the detachment of marines at Midway Islands, the landing point of the Pacific cable, stating that the employees of the cable company have threatened to leave by the next steamer if the order of the Navy Department prohibiting them from carrying firearms and shooting the birds of the island is enforced. The department has replied that the order must be rigidly enforced. The Government is determined to stop the slaughter of these birds of plumage.

ELECTRICITY IN INDIA.—Mr. Leonard R. Douse, president of the London, Eastern & American Trading Company, of Bombay, returning from the St. Louis Fair, remarked: "Many of the mills in East India which have been established for some years are not equipped with electric light, and for this reason cannot run on dark days or on days when the sunset is early. The insurance companies do not allow them to use any naked light. For this reason such companies are forced to install electric plants, and there is plenty of chance for the sale of electrical appliances all through India."

CONSTANT-CURRENT REGULATOR.—In the operation of the constant-current regulator of the relatively movable core and solenoid type, means must be provided for balancing the force of attraction of the current in the solenoid for the core, in order that the current may be maintained at the proper value. Mr. J. H. Hallberg, according to a patent issued August 9, 1904, proposes to place the solenoid and core within a tank containing a fluid-tight compartment, and to connect the core mechanically with a float more or less submerged in oil, according to the relative positions of the core and solenoid. The shape of the float, which determines the change in buoyant force with change in position, serves to regulate the operating value of the line current.

NORTHWESTERN ELECTRICAL ASSOCIATION.—Mr. T. R. Mercein, secretary of the Northwestern Electrical Association, reminds members of the convention in St. Louis, September 12-16, the week of the International Electrical Congress. He asks to be advised at Milwaukee by all who intend participating. The headquarters will be at the Forest Park University Hotel, a fine permanent building quite near the Exposition. The special rate is $1.50 a day for each person, if two share a room. Meals are served *a la carte*. Special railroad rates are also made of $8.50, Milwaukee to St. Louis and return, and $6 round trip from Chicago. Mr. Mercein and the officers are preparing a good programme, while many of the members are also enrolled for the Congress.

ELECTRICAL EXHIBITION AT YORK, PA.—The Merchants' Association, of York, Pa., has announced through its secretary, Mr. Clarence Keasey, that an electrical exhibition will be held in York next spring to celebrate the opening of the York Haven power plant and the reception of its power in York. This exhibition will be entirely novel in its plan, inasmuch as the whole town will be the exhibition grounds. The merchants will give their show windows to exhibitors for their displays, and the streets will be opened to manufacturers of electric lights of all kinds to exhibit the value of their illuminants. A separate square or block will be given to each form of lamp, so that the effect may be readily judged. All forms of electrical devices will be welcomed, and both space and power will be furnished gratis. It is trusted that the result will be a novel display that will exceed in originality any that has been made before.

STREET RAILWAY SECURITIES.—In an interesting article on investments and the characteristics of investors, the *Railroad Gazette* says: "Street railway securities have brought into view another phase of psychology in investment. Unlike the steam roads, the electric street railways found little difficulty in securing capital for construction, but for some years the timidity of investors kept at par or below the 5 per cent. bonds of the most promising new lines of Eastern cities. More suggestive is the fact that the street railways are localized properties, and even when 'controlled' by the outside syndicates, usually rest on local investment. As distinguished from the steam road, the street railway is thus generally a property which the investor can watch, and which often is operated by a local corporation whose officers the investor knows personally. How far this 'locality idea' operates as such a sentiment, and as a factor of confidence in the mind of the cautious investor, cannot be stated in terms. But, were statistics available of, for example, the number of street railway bonds held in the city or town where the line is situated that local motive would probably be found very effective as a connecting nerve between the investor's brain and pocket."

VARIABLE-SPEED SHUNT MOTOR.—The principal feature of novelty in an invention relating to this subject, for which a patent was granted to C. P. Steinmetz August 9, 1904, resides in the fact that the armature winding is composed of open-circuited sections, preferably three for each pair of poles. The adjacent ends of adjoining sections are connected to two corresponding segments of two segmental rings. For each pair of poles there is provided a group of brushes insulated from each other and from the frame of the machine, and each arranged to connect the corresponding segments in two rings as they pass under the brush. The brushes are so spaced that the sections of the armature winding between the poles in any given pair of poles are connected, while the section or sections between every two pairs of poles are left open. At each pole is a brush bearing on the commutator, to whose segments the armature coils in each section are connected, as usual. The result is that there are as many separate armature circuits as there are pairs of poles. For instance, a twelve-pole machine will have six distinct armature circuits. By means of a suitable controller, these circuits can be grouped in various ways, either in series for low speed, series-multiple for intermediate speed, or multiple for full speed.

ELECTROLYTIC CONVERTER.—In certain branches of Röntgen-ray work, particularly in the medical department, it is desirable to secure very rapid pulsations of the current and also to provide an interrupted direct current instead of an alternating current. For this purpose, W. B. Churcher makes use of the ordinary Röntgen-ray bulb connected to the well-known induction coil, but as a source of interrupted current for the primary of the coil he employs a special type of electrolytic converter, for which a patent was granted to him August 9, 1904. The cell, of which the electrolyte is preferably phosphate of soda or potassium, contains three electrodes, two of aluminum and one of some metal not easily attacked by the electrolyte, such as platinum or gold. The aluminum electrodes are connected directly to the outer leads from an alternating-current transformer, while the two primary terminals of the induction coil are connected respectively to the neutral point of the transformer coil and the third (gold or platinum) electrode of the cell. Under operating conditions the third electrode will be positive to one of the aluminum electrodes and negative to the other at either phase of the current. The nature of aluminum in an electrolyte is such that only negative current will flow from the platinum or gold electrode to whichever of the aluminum electrodes happens to be positive thereto. The interruptions of the current, other than what are due to the alternators of the supply system, are produced by reason of the small surface of the platinum or gold electrode which is exposed to the electrolyte, and at which, upon passage of the current, there is produced gas in sufficient quantity to insulate the electrode and interrupt the current.

LETTER TO THE EDITORS.

The Government Use of Wireless Telegraphy.

To the Editors of Electrical World and Engineer:

SIRS:—Disputes with reference to commercial matters are, however, not as a rule particularly interesting or particularly dignified. For this reason the National Electric Signaling Company does not care to be drawn into or to continue a discussion of this character. The statements made by Mr. White, of the De Forest Company, in your issue of July 16 are, however, so at variance with the facts and capable of being so injuriously interpreted with reference to this company, unless corrected, that we have decided to request the publication of the following statements:

With reference to Mr. White's statement that the navy contracts "are the result of the recent official tests of the De Forest system," and of the statements made elsewhere that "all the war vessels of the American navy will be equipped with the De Forest system and that the Government has adopted the De Forest system and entered into a combination with the company controlling it," and that the contracts were awarded as the result of "most rigid tests conducted by Government experts extending over three months, who reported that the De Forest system was the one which offered the best service, though its terms were higher than those of other companies," the following communication between this company and the Navy Department will, I think, show what the actual facts are:

"WASHINGTON, D. C., July 12, 1904.

"U. S. Bureau of Equipment, Navy Department:

"SIR:—This company was recently requested by your department to furnish apparatus in connection with a competitive test of wireless apparatus, this test to take place some time during July or later. With reference to same, I would respectfully request information in regard to the following points:

"1. Whether the statement recently published to the effect that 'all the war vessels of the American Navy will be equipped with the De Forest apparatus,' is correct or not, and that the Government has 'adopted the De Forest system and entered into a combination with the company controlling it.'

"2. Whether the recent navy contracts for the Gulf of Mexico were awarded as the result of 'most rigid tests conducted by Government experts extending over three months, who reported that the De Forest system was the one which offered the best service, though its terms were higher than those of other companies.' Very respectfully, NATIONAL ELECTRIC SIGNALING CO."

"NAVY DEPARTMENT, Washington, D. C., July 14, 1904.

"GENTLEMEN:—Your letter of July 12 is received.

"As you state, your company was requested by this Bureau to furnish apparatus in connection with competitive test of wireless systems in the vicinity of New York; your turn was, as you say, to take place some time during July or later. The competitive test is incomplete.

"With regards to paragraphs 1 and 2 of your letter, the most appropriate answer the Bureau can make is by enclosing a copy of specifications for instruments to be installed in Florida, Porto Rico, Guantanamo Bay, and probably one on the Isthmus of Panama. These specifications contain all the agreement that existed between the Navy Department and the contracting company.

"You were given an opportunity to bid on the same routes, but the price asked by the National Electric Signaling Company was higher than that of the American De Forest Wireless Telegraph Company.

"The Bureau has no concern with the various newspaper articles which have appeared from time to time on this subject, and does not care to express an opinion regarding their accuracy.

"The statement contained in the quotation in paragraph 1 of your letter is untrue.

"Replying to the question in paragraph 2 of your letter, I will say that the purchase of the instruments was *not* the result of the test by the Bureau of any system. Very respectfully,

"BUREAU OF EQUIPMENT, U. S. NAVY."

The fact is that in view of the fact that the De Forest Company's bid was less than ⅙ that bid by the National Electric Signaling Company, that the Navy had no option but to accept the lowest bid. Whether the De Forest Company is able to carry out the contract is a matter which remains to be seen.

With reference to Mr. White's statement that the Signal Corps has obtained satisfactory results during the past two years with the De Forest system, the enclosed statement, made by General Greely, will, I think, cover the point. This statement was made by General Greely as the result of his attention having been called to the fact that the De Forest Company was advertising its system as "endorsed by the United States Signal Corps."

From *Washington Post*, May 17, 1903:—"That is what I call an outrage," remarked General Greely, of the Signal Corps, the other day. "Here is a letter from a man asking me what I know about a certain system of wireless telegraphy, and he incloses a circular of the company, in which it is stated that I endorse this system. As a matter of fact, I never endorsed any system of wireless telegraphy. I would be glad to do so, and put it in operation for the Government as soon as a satisfactory kind is presented to me. I don't even know much about this particular system which I am said to have endorsed. Now, what is a man to do in a case of that kind? That circular has been sent everywhere, and there is no way for me to reach the men who might be deceived by it. Probably some men are wondering how much stock I have in the concern. All this is what makes it annoying."

It should be noted up to that date the Signal Corps had never had a set of the National Electric Signaling Company's apparatus installed.

With reference to the Alaska installation which Mr. White states this company's system has never made good, the facts are that that contract was awarded to an agent too late in the season to get the masts up to Cape Nome, and the contract was therefore cancelled, without any test having been made of the system. A similar statement published under the signature of the De Forest Company to the effect that this company's system had been tried between Forts Schuyler and Wright for a month and had failed, is absolutely untrue. The facts in this case are that this company was directed to install its apparatus, but after the operators had been at the stations three or four days, getting into shape for the test, General Greely decided to request us to postpone our work until he could make some further test with the apparatus which was to be sent to Alaska, informing us at the time that on the conclusion of the above-mentioned tests we would be at liberty to proceed with our own installation, and we were recently notified to take up the work again, and our stations are now working between these points.

With reference to the United States Weather Bureau, so far from the Weather Bureau adopting or approving the De Forest apparatus, the facts are that the Weather Bureau agreed to purchase two sample sets of the De Forest Company's apparatus, under a misapprehension as to the ownership of the liquid barretter, but on fuller investigation decided that the apparatus of the National Electric Signaling Company was so much superior that a contract was prepared by which the Weather Bureau bound itself to use the apparatus of the National Electric Signaling Company *exclusively* for a period of fourteen years. This contract was approved by the Secretary, and the Weather Bureau endeavored to avoid taking the De Forest apparatus, but was unable to do this. Before this contract could be signed a board was appointed by the President to determine which Government department should have charge of the Government wireless stations, but meantime the Weather Bureau had placed itself on record to the effect that its tests had established the superiority of the National Electric Signaling Company's system.

With reference to the statement that the National Electric Signaling Company had been employing the hot wire barretter for the past few years, we would say that this is entirely false, as the liquid barretter has been employed by this company for all commercial work for over a year and a half.

With reference to the statement that the liquid barretter was invented by Mr. Vreeland, this is a falsehood manufactured out of whole cloth, as the liquid barretter had been used for nearly two years before Mr. Vreeland had any connection with the company, and the first time Mr. Vreeland ever saw the liquid barretter or knew that it would operate as a receiver, was when he was called in by Professor Fessenden from some other work on which he was engaged in order to witness its operation. So far as we know, Mr Vreeland has never claimed to have invented the liquid barretter, and we are inclined to consider that this statement of Mr. White's has just as much foundation as the other statements referred to above.

With reference to Mr. White's statement that "had Mr. Glaubitz waited one week for the recent announcement of the contracts he

would have found it quite unnecessary to accuse the navy of undue partiality to a German system." If any one interesting in checking the correctness of Mr. White's statements will refer to the communication referred to he will see that Mr. Glaubitz stated: "There is this much to be said for the navy, that when the facts were finally placed plainly before the department it realized at once that the American companies had not received justice in the matter, and it may be stated with some degree of certainty that the American systems will have an opportunity of showing what they can do." It is interesting to note the fact that this statement has been confirmed, and the way Mr. White has distorted it into an accusation that the navy is unduly partial to a German system.

Exception might be taken to a great many other statements made by Mr. White, but it is believed that the above will indicate the general character of these, and, so far as this company is concerned, it is considered unnecessary to continue the discussion further.

WASHINGTON, D. C. REGINALD A. FESSENDEN,
National Electric Signaling Company.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Three-Phase Transformation.—PECK.—An illustrated article on three-phase transformation, in which the author discusses the advantages and disadvantages of the core type and shell type of three-phase transformers and reaches the following conclusions: Where it is desired to transform from single-phase to three-phase for supplying small motors, rotary converters, etc., the three-phase, core type transformer is cheaper, more efficient and more compact than a group of two or three single-phase transformers. There are, however, objections to its use, which, under certain conditions, may offset the advantages which it offers. Any three-phase transformer, which is made up of three single-phase units joined together by a common core, presents but little gain in cost, efficiency or compactness over three separate single-phase units, while there are several distinct objections to its use. For large three-phase units, the shell type construction is commonly employed and, since this consists of three single-phase units with a common core, it has few advantages and several disadvantages over a group of three single-phase transformers. The few advantages claimed for the three-phase, shell type transformer, over a group of three single-phase transformers, are: Slightly reduced cost, reduced floor space and simplification of connections. The duplex transformer (two single-phase transformers connected in T and mounted in the same case) is a cheaper arrangement than the three-phase transformer, and requires slightly less floor space, and its connections are just as simple. No three-phase transformer, or group of single-phase transformers, can be as cheap, efficient or compact as a single-phase transformer having the same aggregate output; thus the economical use of the three-phase transformer is practically limited to that of supplying three-phase motors and rotary converters, while the single-phase transformer can almost always be used to better advantage for lighting work.—*Elec. Club Jour.*, August.

LIGHTS AND LIGHTING.

Nernst Lamp.—OWEN.—An account of experiments made to see if a discharge of electricity takes place in the case of the glowing filament of the Nernst lamp. The principal results are as follows: From a glowing Nernst filament there is at all pressures a discharge both of positive and negative electricity. The negative leak behaves in a perfectly regular way, diminishing only slowly with the time, and is not liable to those sudden variations which occur in the case of the negative leak from platinum. During the whole course of the experiments the negative leak did not suddenly change without any apparent cause more than three or four times. The negative leak at certain pressures shows the effect of ionization by collision. The negative leak, when no ionization by collision occurs, increases as the pressure is diminished until a pressure of a few millimeters is reached; it then remains constant down to a low vacuum. The negative leak increases rapidly with the temperature of the filament. At low pressures for a considerable range the negative leak under a high potential is proportional to the pressure. From a filament which has not been heated before there is a large initial positive leak which rapidly dies away. After long-continued heating of the filament the positive leak becomes fairly steady, but still continues to diminish with the time. The positive leak increases with the temperature of the filament, but not so rapidly as the negative leak. The carriers of the negative leak in a vacuum are corpuscles, while the carriers of the positive leak are particles of molecular dimensions.—*Phil. Mag.*, August.

REFERENCE.

Photometric Tests of Incandescent Lamps.—LEONARD.—With reference to a paper by Russel, the author points out that the fundamental figures which determine the quality of a source of light are the total flux and its different distribution in various zones. He emphasizes the fundamental importance of determining the total flux and describes a method which is based on the fact that the flux is the product of a known figure by a sum of intensities of lights in different azimuths, which sum can be directly determined by photometric methods.—*L'Eclairage Elec.*, July 23.

POWER.

Electric Power in Quarries.—WILLEY.—An illustrated article on marble quarrying in America as a new field for electric power service. The author deals with the power equipment of a large quarry in Vermont. In the group of plants described steam is utilized merely as an auxiliary source of power, for of the 2,000 hp needed for present purposes, only 200 are secured from steam. The distribution of electric power obtained from water power has been found so satisfactory that extensions are being made which, in the near future, will permit every portion of the equipment used in quarrying, hoisting and transferring the blocks, as well as the mechanism for finishing the material for commercial purposes, to be operated by electric motors and compressed air; only the sawing and preliminary surfacing being done by water power direct. There will be three turbines of 1,000 hp each.—*Cassier's Mag.*, August.

REFERENCES.

Water Power Developments.—REID.—An article in which the author points out that sometimes water power developments are undertaken with an overestimation of the available power and without sufficient attention to the cost of development and operation and to the available market for the developed power. He discusses in a general way the investment required, the operating expenses and the income from water power developments.—*Cassier's Mag.*, August.

New Orleans.—An article on a new large power plant in New Orleans, which will have an ultimate capacity of 60,000 hp, and will be equipped with turbo-alternators. Three 500-kw units will be installed at once, to be followed by others of about 5,000-kw capacity. The boiler room is in two stories.—*St. R'y Jour.*, August 6.

Steam Turbines.—CHRISTY.—An illustrated article on the equipment of a plant for testing steam turbines and of the methods of testing.—*Elec. Club Jour.*, August.

Electric Pump.—An illustrated description of a high-speed, electrically-driven pump. It delivers 250 gallons per minute against a head of 1,000 ft. when running at 300 r.p.m. The results of the tests of the pump driven by a six-pole, 100-hp, 200-volt, shunt-wound motor are given. The efficiency of the combined set varies between 78 and 84.4 per cent.—Lond. *Elec.*, July 22.

Electric Fire Engine.—An illustrated description of a fire engine consisting of a cylindrical tank mounted on two wheels and provided with running handles, with an electric motor and pump fitted on a wooden cover. The motor is wound to run at 100 volts and gives half a horse-power at a speed of 1,200 r.p.m. The pump is of the rotary type and is driven by the motor through worm gearing

at a speed of about 200 r.p.m. It delivers about 20 gallons per minute at 50 to 60 pounds pressure.—Lond. *Elec.*, July 22.

Hoists.—An illustrated description of single-phase hoists. The lifts are operated by Heyland motors.—Lond. *Elec.*, July 15.

Engines.—An account of tests of central-valve engines of a British company working with highly superheated steam.—Lond. *Elec.*, July 15.

TRACTION.

Australian Tramway System.—An article on the tramway system of Sydney, which is owned by the State of New South Wales. Electricity was first tried in 1893, and since that time most of the lines have been equipped with electricity. Power is distributed at 6,600 volts to sub-stations which are equipped with rotary converters. The company has just ordered a turbo-generator.—*St. R'y Jour.*, August 6.

Railway Power House.—Continuations of the illustrated description of the North Eastern Railway and Carville power house. The switchboard is described in detail. For transmission to sub-stations three-phase currents at 6,000 volts, with a frequency of 40 periods per second, are conveyed by three-core cables. Current is supplied to the North Eastern Railway from nine sub-stations, irrespective of a number of small transformer stations for lighting purposes. The largest sub-station contains four 800-kw rotary converters for supply to the railroad, fed from 13 transformers, aggregating 3,800 kw, with an induction regulator for lighting supply to the railway. There are also two 500-kw induction motor-generators and a 1,000-kw-hour storage battery with a reversible booster for serving the three-wire network of the supply company.—Lond. *Elec.*, July 15, 22.

Paris.—An article on extensions of the third-rail system of the Paris-Orleans Railway. In order to avoid the use of steam locomotives in the tunnels at the Paris terminus, electric locomotives were originally installed to haul the passenger trains a distance of 4 km. from the Austerlitz Station to the Orsay Station. The system has now been extended to Juvisy. The old electric locomotives have been changed by reducing the gear ratio from 4 ÷ 1 to 2.23 ÷ 1, to get higher speed. In addition, the company has put in two multiple-unit trains to take care of the suburban service between Orsay and Juvisy. The arrangement of the train control system is somewhat different from that in use in the United States, as all of the apparatus, including the controllers, reversers and relays, are placed inside of the car cab instead of underneath the car floor.—*St. R'y Jour.*, August 6.

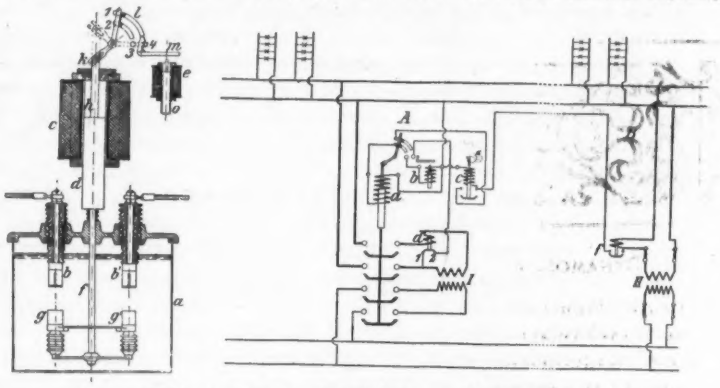
REFERENCES.

Maintenance of Electric Railway Equipment.—WEBSTER.—An illustrated article. There are two railroad systems of maintenance in extensive use. The first is the mileage system, which is generally used by large railway companies, the car being taken out of service as often as it has run a definite mileage, about 12,000 miles for interurban service and somewhat less for city service. The second is the inspection system, the cars undergoing a daily or trip inspection of a thorough character and being sent to the shop for general repairs only when the wear of wheels, bearings, commutator or other vital parts require it. The author describes at some length the methods of inspecting the motor equipment, and the lubrication by means of oil and waste and discusses the care of wheels, commutators and brushes, etc.—*Elec. Club Jour.*, August.

Regenerative Control for Tramway Motors.—An article on a demonstration of the Raworth regenerative control for electric tramway motors, also on the demi-car, on which the same was used. The Raworth regenerative control depends essentially on the use of shunt motors instead of series motors on the car. During the tests the car in descending a hill with 20 passengers returned 35.75 per cent. of the energy which it took when ascending the hill.—Lond. *Elec. Engineer*, July 29.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Switches.—LINDENSTRUTH AND FORSTER.—An illustrated description of various switches actuated from a distance. In the first class of such switches the operating coils are always supplied with current. Their design is in general very simple, but they are somewhat expensive since they always carry current. In the two other classes the operating coils carry current only in the moments when the circuit is closed or broken. They are arrested either by mechanical or magnetic devices. Among others, the authors describe the following automatic switch in which the circuit is broken under oil. In Fig. 1 *a* is the vessel containing the oil; fitted on its top plate by means of porcelain insulators are the contact pieces, *b*. Above the oil vessel the operating coil, *c*, is provided. The core, *d*, carries, by means of the rod, *f*, the pieces, *g*, which close the circuit. The core, *d*, carries at its top a thinner rod, *h*, which is provided at its end with a pin sliding in the fork of the lever, *k*. The latter carries a brush which connects either 1 with 2 or 3 with 4. The switch acts as follows: If the coil, *c*, is excited, it attracts *d* and the circuit



FIGS. 1 AND 2.—DIAGRAMS OF SWITCHES.

is closed through *b*, *g*, g^1, b^1. Simultaneously, the lever, *k*, is brought into the position indicated by dotted lines in Fig. 1, where it is arrested by the catch, *m*. While this takes place, the contact, 1, 2, is broken and the contact, 3, 4, is closed. The breaking of the contact, 1, 2, has the result that the operating coil, *c*, no longer carries current, while the closing of the contact, 3, 4, has the result that the disconnecting coil, *e*, may now be excited. If it is excited, it attracts the core, *o*, which pushes against *m* and releases the lever, *k*, from the catch, so that the core, *d*, drops down and the contacts between *b* and *g* are broken. These switches may be used for direct as well as alternating current. Fig. 3 shows the connections of such a high-tension switch for actuating from a distance. The relay, *R*, is here added, which, when the current becomes greater than a certain predetermined amount, closes the circuit containing the disconnecting coil, *e*; in this way the switch becomes an overload circuit-breaker. Fig. 2 gives th- connections for two trans-

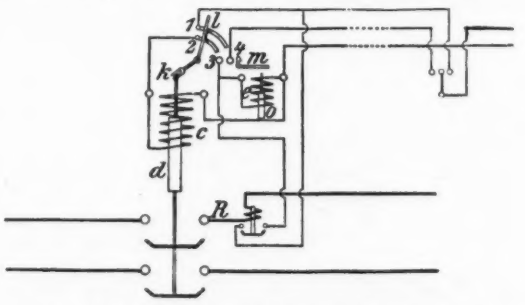


FIG. 3.—DIAGRAM OF SWITCH CONNECTIONS.

former stations, which supply a given low-voltage network from different feeding points. In order to keep the no-load losses as small as possible for low load, the transformer, *I*, is arranged so that it may be disconnected. For medium load the station *B* is sufficient. When the load reaches a certain amount the relay, *f*, in Station II, closes the circuit for the time relay, *c*, which, after a certain adjustable time, closes the circuit for the coil, *a*, so that the transformer, *I*, is connected to the circuit. In the low-voltage winding of the latter a relay, *d*, is provided, which breaks the contact, 1, 2, when the current reaches a certain value. If the load of the network decreases *d* closes at 1, 2, the circuit for *b*, and the transformer, *I*, is again disconnected. By adding a maximum relay in Station A, it is possible to protect the transformer, *I*, against too strong currents.—*Elek. Zeit.*, July 28.

Polyphase Sub-Stations.—PEARCE.—His fully-illustrated paper recently read before the (British) Municipal Electrical Association. The general conclusions reached by the author are as follows: For traction systems, very strong reasons must exist if the claims of the rotary converter operating at 25 cycles are overlooked. They are at least 5 per cent. more efficient than either of the other equipments; their ability to stand considerable overloads and the high power factor at which they can be operated outweigh their disad-

vantages. For mixed lighting and traction, lighting considerations will probably settle the type of equipment, and for this synchronous motor-generators operating at 50 cycles appear best to fulfill the majority of conditions required, viz.: ease of regulation of direct-current pressure, satisfactory parallel running, little or no variations in pressure; in short, they are not so sensitive as rotaries and they can also be worked at an equally high power factor. It is possible that the disadvantages of the rotary are sometimes exaggerated. Their large use in the United States and increasing use in England point to the fact that under special circumstances their adoption may be deemed warranted. In the case of direct-current lighting and power systems much difficulty will perhaps be experienced in deciding on the respective merits of synchronous versus induction motors. The drawback to the latter is that the current is always a lagging one, and the smaller sizes have a relatively low power factor. There is also a gain of 1 to 2 per cent. in efficiency in favor of the synchronous type, to balance which may be placed the extra complications in switch gear. For units of 500 kw and over, the author considers that either type might be usefully employed, the increased cost of the induction type being balanced by the increased cost of switch gear with the synchronous type. For units of less than the above output, a combination of both types has worked with advantage, the leading currents of the one compensating for the lagging currents of the other, while the induction motors provide the necessary means of starting up the sub-station machinery from the high-tension side in event of failure on the direct-current side of the system.—Lond. *Elec.*, July 22.

REFERENCE.

Switch.—HÖNIG.—An illustrated description of a switch for automatically closing and opening certain circuits from a distance at certain adjustable hours. The device is an electromagnetic one and is operated from a small local battery.—*Zeit. f. Beleucht.*, July 30.

WIRES, WIRING AND CONDUITS.

Insulator Pins.—ADAMS.—An article in which the author explains why insulator pins are among the weakest elements in many electric transmission systems. The author points out that to meet the conditions of transmission work a change in both the shape and size of pins is necessary. The shoulder on pins where the shank and stem meet should be entirely discarded. An excess of strength should be given to the stem of the pin by increasing the diameter and strength near the top of the pin. The shank of each pin should be proportionately shorter than in the older type and the pin-hole should be bored only part way through the cross arm. With these changes in general design the pin is a simple cylinder in the shank, with a gentle taper from the shank to form the pin. The lack of strength in wooden pins and their destruction in some cases by current leakage is leading to the use of iron and steel pins.—*Cassier's Mag.*, August.

REFERENCE.

Single-Phase and Polyphase Cables.—LICHTENSTEIN.—The first part of a mathematical article on the calculation and experimental determination of the inductance and the charging current in single-phase and polyphase cables. He shows how the calculation of a cable may be reduced to that of an ideal conductor.—*Zeit. f. Elek.* (Vienna), July 31.

ELECTRO-PHYSICS AND MAGNETISM.

Rectifying Effects in Conducting Gases.—NUTTING.—An account of an investigation (referred to editorially last week) made to determine what conditions of a metal or gas favor the transfer of electricity from one to the other. If a direct current is used in studying the electrode drop in potential, the difficulty is to keep the condition of surface, temperature, pressure, etc., constant and to reproduce these conditions in successive tests. But if an alternating current is used of a maximum voltage, just a little above the maximum total drop of potential between the electrodes, conditions cannot appreciably change between successive alternations and the excess of current in one direction may be taken as a rough measure of the relative surface conductivity at the two electrodes. Any rectifying effect must be regarded as due to conditions existing at the metal-gas surface and in the immediate adjacent metal and gas. A series of experiments was made in this direction. A difference in pressure of the gas about the two electrodes was produced by connecting the tube to a fine capillary between the electrodes and rapidly exhausting. If the current is carried by negative electrodes alone, it will be able to start much more easily from an electrode surrounded by the more rarefied gas, for here the electrons will have a greater free path and will be more easily able to attain ionizing velocity. Hence, the (negative) current will travel most easily from low pressure to high pressure. This agrees with the observation. If the current is also carried by positive electrons the strong current of gas through the capillary from high to low pressure would tend to sweep the larger positive electrons with it rather than the much smaller negative electrons. Hence, the (positive) current flows from higher to lower pressure, as observed. The relative size of the electrodes is an important factor in producing rectification; the excess of current flows from the small to the large electrode. A difference in temperature of the electrodes gives a partly rectified current from the hot to the cold electrode. When one bulb of a Plücker tube is filled with mercury vapor and the other with air or hydrogen, there is a decided rectifying effect from the mercury vapor toward the hydrogen. The condition of the surface of the electrodes appears to determine a slight but decided rectifying effect. —*Phys. Rev.*, July.

Emanations and Emissions.—SOLVAY.—In one type of air compressors the heating of the apparatus is prevented by injecting cold water in a fine spray. Now, although the pressure curves indicate very high temperature of the compressed air the thermometer shows a heating of the walls amounting to only a few degrees; it is evidently only the temperature of the water that is indicated. On the basis of this fact he makes the following argument: Most telluric substances are of a heterogeneous structure, and it is possible that some minute portion of them may remain for a considerable time at a temperature greatly exceeding the temperature in the medium in which they are contained. This may account for forms of energy emanating from apparently cold bodies, which are ordinarily associated with high temperatures only.—*Comptes Rendus*, July 4; Lond. *Elec.*, July 22.

REFERENCES.

Alternating-Current Diagrams.—KARAPETOFF.—In a continuation of his serial on applications of alternating-current diagrams, he discusses several examples from transformer practice.—*Elec. Club Jour.*, August.

Electric Convection in Liquids.—COTTON AND MOUTON.—An account of experiments on the movement of colloids under the influence of an electric current.—*Comptes Rendus*, June 27; Lond. *Elec.*, July 22.

N-Rays.—BECQUEREL.—An account of experiments in which he has discovered some remarkable resemblances between the penetrating radium rays and N-rays on the one hand and between the non-deflected polonium rays and N_1-rays on the other hand.—*Comptes Rendus*, July 4; Lond. *Elec.*, July 22.

ELECTRO-CHEMISTRY AND BATTERIES.

Edison Battery.—SCHOOP.—The conclusion of his paper on the results obtained in an experimental investigation of the concentration changes and diffusion phenomena in the electrolyte contained in the pores of the plates of the Edison accumulator, and also of the expansion and contraction of the active materials which accompany discharge and charge. The author describes the behavior of the nickel electrode during discharge at low and high rates. The characteristic feature of the behavior of the nickel electrode (which distinguishes it, for instance, from the iron electrode) is a strong contraction of the active nickel material during discharge. Especially at the moment when the potential of the nickel electrode drops suddenly, the active material undergoes a rapid and strong contraction. The main results of the investigation are summed up by the author as follows: The method of measurement, using an electrode suspended on a scale, enables one to study the changes of volume of the active masses of the electrodes and the diffusion phenomena during and after the passage of the current. The changes of volume are greater for the active nickel mass than for the active iron mass, and they are greater the farther the discharge is pushed. Roeber's theoretical conclusions were confirmed by the experimental investigation. At both electrodes strong concentration differences are produced during the passage of the current, while the concentration of the free electrolyte between the plates, as well as the average concentration (i. e., the total content of KOH in the electrolyte) remain constant. During the discharge the solution becomes more con-

centrated in the pores of the nickel electrode and becomes more dilute in the pores of the cadmium or iron electrode; during charge the opposite effect is observed. A so-called polarization, i. e., exhaustion of the electrodes, due to dilution of the solution in the pores (corresponding to the exhaustion of sulphuric acid in the lead accumulator), seems to exist to considerable extent in the iron electrode. The iron electrode, therefore, shows a "recovery" of potential (increase of e.m.f.) after the interruption of the current, due to the diffusion of the electrolyte into the pores of the plate. It is probable that the increase of temperature has also an essential influence on the capacity of both electrodes. The measurements appear to justify the conclusion that the alkaline accumulator with constant electrolyte has a higher temperature coefficient than the lead accumulator, and that the temperature coefficient is positive. The author finally states that, according to investigations of Foerster, the temperature coefficient of the Edison accumulator is positive, and is about 0.0007 (in the average) for one degree between 0 and 30° C.—*Electrochem. Ind.*, August.

REFERENCE.

Electrometallurgy.—IZART.—The first part of a review of the present situation of electrometallurgical industries. The author first makes some remarks on electric furnace processes for making special steels and ferro alloys. He then discusses the manufacture of aluminum and sodium, and various furnace processes suggested for copper, zinc, nickel and mercury. He thinks that to get pure metals electrolytic action should be combined with a furnace process, as is the case in the manufacture of aluminum and sodium. In other cases the electric furnace is useful only for producing a matte of 40 to 50 per cent. at a place near the mines.—*L'Industrie Elec.*, July 10, 25.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Voltmeter for Automobiles.—A note on a voltmeter for indicating the amount of useful charge left in a storage battery during a discharge at any rate. The voltage across the battery on open circuit alone is no indication of the remaining useful charge, while the voltage across the battery with a given current flowing is equally misleading. In order that the instrument shall correctly indicate the half full point for any rate of discharge, it must read the voltage across the battery plus an amount approximately proportional to the current flowing; that is, it must be a voltmeter with an additional series coil. The instrument consists of an iron core, wound with a shunt and a series coil, and has a scale marked "Empty," "Half full" and "Full." The core is fitted with a pole piece so shaped as to produce a scale proportional to the ampere-hour discharge, which attracts a soft-iron armature actuating the pointer shaft, the motion being controlled by a strong spring. As no jewels are used, the instrument is not sensitive to vibration.—*Elec. Club Jour.*, August.

REFERENCES.

Alternating-Current Voltmeter.—A note stating that in order that a voltmeter of the induction type containing an aluminum disc revolving in the air-gap of an electromagnet may not be affected by a variation of frequency, it is necessary to insert a non-inductive resistance in series with the instrument. The reason for this is briefly explained.—*Elec. Club Jour.*, August.

Oscillograph.—SOLIER.—An illustrated description of new models of Blondel's oscillograph made by Carpentier.—*L'Eclairage Elec.*, July 30.

TELEGRAPHY, TELEPHONY AND SIGNALS.

REFERENCE.

Propagation of Telegraph Currents.—POINCARÉ.—The first part of a mathematical article on the propagation of currents with varying frequency over a line containing a receiver. The author first gives the fundamental differential equations for the transmission of telegraphic currents and then integrates them. The article is to be continued.—*L'Eclairage Elec.*, July 23, 30.

MISCELLANEOUS.

Biographical.—A biographical sketch of Edwin Wilbur Rice, Jr., the technical director of the General Electric Company, with portrait.—*Cassier's Mag.*, August.

New Insulating and Fire-proofing Material.

One of the most noticeable developments in electric railway work during the past two or three years is the growing tendency toward the use of fire-proof insulation on cars. This step was first thought necessary in underground work but it is gradually becoming common in elevated railway service, and is now being adopted on the surface cars in order to comply as nearly as practicable to the recent recommendations of the Board of Underwriters, which require underframes to be covered with a fire-proof insulating material.

A new material for this purpose has recently been brought out by the Keasbey & Mattison Company, in two different compositions, one based upon asbestos and the other upon magnesia. The former, which has been named asbestos building lumber, is composed of asbestos fibre, each fibre being coated with a cement, and these coated fibres then properly united by a peculiar process, giving the resulting material a fibre-like construction, which adds incalculably to its strength. The other material, in which magnesium silicate is used, has been termed magnesia building lumber, the natural fibres of magnesia silicate being felted together and thoroughly cemented by the use of an artificially created magnesium silicate, crystallized within and around the natural fire-proof fibres employed in making the felt. Under great pressure, both materials can be molded to any shape, but for general use are made up in boards or panels of standard sizes, which may be sawed or cut to meet requirements. The materials are capable of receiving very severe shocks and very rough treatment without breaking. They partake somewhat of the nature of slate or stone in that when hammered they emit a sonorous sound like earthenware.

A number of important tests have been made of this new material, perhaps the most important by Prof. G. F. Sever, of Columbia University. The object was to determine the principal characteristics of the two materials, of which the most important are as follows: the electrical resistance, the breakdown voltage, the effect produced by the heat of an arc, the capacity for absorbing moisture, the structural strength, and the susceptibility of sawing and nailing.

The tests for electrical resistance were made at 550 volts, and showed, for the ⅛-in. asbestos lumber, an insulation resistance per inch of thickness of from .97 megohms up to 2.3 megohms; for the ¼-in., from .2 megohms up to 1.2 megohms, while in the ½-in. thickness the insulation resistance ranged from .8 megohms to 1.5 megohms per inch of thickness. The magnesia lumber showed even more favorable results—that is, for the ⅛-in. thickness from 1.3 megohms up to 8.7 megohms; in the ¼-in. thickness, from 1.05 megohms up to 4.1 megohms, and in the ½-in. thickness, from 1.09 megohms to 3.5 megohms, due probably to the greater resisting qualities of magnesium silicate over that of cement. The specimens tested were 6 x 6 in.

The break-down voltage test was made upon specimens of both materials dried five hours at 150° F., and also upon specimens which had not been dried. In the asbestos lumber the results showed break-down voltages ranging from 7000 to 21,000 volts per inch of thickness of the material, while, when undried, the break-down voltage required ranged from 3700 up to 12,000 volts per inch of thickness. In the magnesia lumber the difference between the undried and dried specimens was practically the same. In the thoroughly dried magnesia lumber, the break-down voltage varied from 9000 to 30,000 volts per inch of thickness, while, when undried, it ranged from 4800 up to 15,000 volts per inch of thickness.

The absorption tests tend to indicate that both materials absorb a certain amount of moisture, the magnesia lumber showing the greater tendency in this direction. The highest absorption that could be obtained with the asbestos lumber was an increase in weight of from 16 per cent to 21 per cent after soaking in water for forty-eight hours, while the magnesia lumber absorptions ranging from 25 per cent to 38 per cent were obtained. In either case, however, the material proved capable of being dried out to practically its original weight; in some cases, however, showing an increase after such treatment of from .1 per cent to 3 per cent.

From the tests it would again appear that the asbestos, while not so high in insulation resistance as compared with magnesia building lumber when perfectly dry, is the better material for use under car bodies, and in other places where moisture is liable to be present.

The magnesia lumber lends itself much more readily to being worked with tools such as saws, drills, etc., than does the asbestos; furthermore, the magnesia lumber permits the driving of nails

through it with great facility. Wire nails can be readily driven in the asbestos lumber in thicknesses not over ¼ in. When subjected to a vibratory test in the nature of rapid hammering, the asbestos lumber appeared much more capable of withstanding heavy blows and hard usage. The magnesia lumber proved liable to split if a series of blows or a sudden shock occurred near the edge. It proved very difficult to damage the asbestos lumber by the most severe treatment; as a result of the tests, it was seen not to indent easily, and under the treatment given it did not break. Metal-working tools should be employed in cutting or sawing the asbestos building lumber, under which circumstances the material is readily and economically handled.

As a result of the tests, Prof. Sever concluded that of the two the asbestos lumber possesses better mechanical properties than the magnesia, although the latter is a better electrical insulator than the asbestos, when dry. The asbestos lumber, however, stands higher as a heat-resisting material and an arc-resisting material than the magnesia lumber. Both of these materials, when covered by a paint capable of preventing the entrance of moisture, and which is not in itself of a fire-conducting nature, will prove acceptable as electrical insulators. He found that this treatment of applying the fire-proof paint would be quite essential in cases where potentials of over 500 volts are to be placed in close proximity to the materials.

A series of fire tests of the asbestos lumber was also made by Prof. Ira H. Woolson, E.M., of Columbia University. As the result of these and of other fire tests which their Chicago laboratories have made, the National and New York Boards of Fire Underwriters have recently signified their acceptance of the materials for use under their specifications. The boards have also declared their approval of the use of this material as an insulator, etc., for the protection of car bodies against electric arcs, specifying merely that, in order to obtain structural strength required under such severe conditions, the material be used in ¼-in. thickness.

Important tests of the asbestos lumber for strength have also been made by Prof. Woolson, which indicate that this material compares favorably in strength with ordinary white pine, and results are such as to warrant its use in places where it would be subjected to hard usage.

One of the chief uses to which the material seems well adapted is for insulating and fire-proofing the lower parts of the cars. The New York City Railway Company is using it for this purpose on a large order of new double-truck cars which are being built. The underframing will be very carefully protected in this way, so that derangements to the electrical apparatus cannot result in fire in the car. This company is also putting the asbestos lumber to an important use for the protection of its circuit-breakers; the breakers are housed in compact and neatly arranged boxes, built entirely of this material, and conveniently located beneath the car. The use of asbestos lumber permits any possible destructive arcing to occur at that point without damage or starting a fire in the car framing.

The Interborough Rapid Transit Company is also using the asbestos lumber for protecting the bases of the third rail in the subway, where the rail comes within 3 in. of the metal structure, the object being to prevent any arc passing over. The lumber for this purpose is painted with moisture-proof insulating paint, and is clamped on to the base of the rail. The Brooklyn Rapid Transit Company has just decided to install the asbestos building lumber on twenty new cars just ordered for the bridge service. The specifications of these twenty cars provide that the underflooring is to be covered with asbestos building lumber of not less than ¼ in. thickness, as is provided in the specifications of the cars of the New York City Railway Company. The Montreal Street Railway Company has also recently specified the material for some new cars now being built by the J. G. Brill Company and the Niles Manufacturing Company.

That its uses in the electrical field are manifold goes without saying, and the development of these materials, through several years of experiment, has proven an important departure upon the part of the Keasbey & Mattison Company, which is to be congratulated upon the perfection of so greatly needed a material. This company is now prepared to furnish either the asbestos or magnesia lumber in standard sizes of board, 42 in. x 48 in., and in special lengths up to 100 in., in any thickness up to 1 in. It is also prepared to furnish the materials cut to any shape. The firm of Wendell & MacDuffie, 26 Cortlandt Street, New York, has been appointed sole agent for the introduction of this material in the electric railway and general electric field, and will furnish further information to any one desirous of investigating.

Electric Heating Apparatus

A recent improvement in electric laundry and tailors' irons consists of a stand to receive the iron, which is also a rheostat that is automatically put in series with the iron when placed on the stand, and is short-circuited when the iron is removed. When it is realized that the iron must be supplied with current sufficient to not only provide for radiation, but for the demands for the work while in the operator's hand without material reduction of temperature, it is clear that when the iron is idle the current is in excess of what is necessary to keep it at working temperature. The effect of this excess current is to rapidly raise the temperature far beyond what is desired and if the iron is idle long enough the high temperature is injurious to the heater.

The automatic regulator, operating to reduce the current from 50 to 60 per cent. on the iron and from 30 to 40 per cent. of the total supply from the line, not only prevents the overheating of the iron, but effects a very material saving in the cost of operation, for in

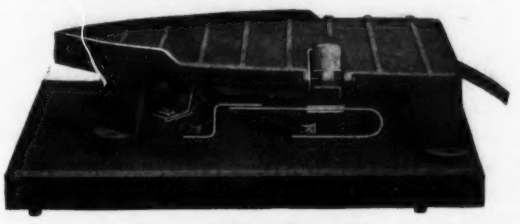


FIG. 1.—STAND FOR IRON.

factory work where irons are in regular use they are shown by tests to be idle from 25 to 40 per cent. of the time they are kept in circuit.

Fig. 1 shows the stand without an iron and Fig. 2 one with an iron in place. The short-circuiting switch is shown mounted on the slate base under the rheostat, which is the support for the iron. An iron lever projects above the surface of the stand when the iron is in use, and the switch stands in the closed or short-circuited position. When the iron is placed on the stand, the lever is depressed by the weight of the iron and the switch is opened.

The stand is wired in series with the iron and the switch so connected that when the iron is off the stand and the switch is in the closed position, it short-circuits the rheostat stand and allows the current to flow directly to the iron. When opened by placing the

FIG. 2.—IRON ON STAND.

iron on the stand, the current flows through the rheostat stand to the iron and effects the reduction of current.

For machine irons and other electric tools not requiring stands, a handle switch is provided to effect the same result when the handle is released by the operator. For electric soldering irons a bench stand for the reception of the iron is provided that produces the same result. For bench work where there is an irregular demand for a soldering iron much time is saved, for the soldering iron is kept ready for instant use with less than half the normal current supply while idle, and no overheating occurs to burn out the iron. These articles are manufactured by the Simplex Electric Heating Company, of Cambridgeport, Mass., and are the inventions of Mr. James I. Ayer, the manager of the company.

A 500,000 Volt Transformer at the St. Louis Exposition.

An exhibit in the Palace of Electricity that is of interest alike to the student of high-potential phenomena and to the high-tension transmission man is found in the booth of C. H. Thordarson, of Chicago. The 500,000-volt transformer exhibited there, while it interests all by the fascinating displays capable of being produced by it, is also of much scientific and engineering interest, for 500,000-volt transformers are not yet seen every day. This transformer is not to be confused with the induction coil type of high-potential apparatus, depending on high-frequency interruptions of the current and having but little energy in the discharge. It is in fact a regular transformer, of 20-kw capacity, of the closed magnetic circuit type, and operated from 110-volt, 60-cycle mains. The primary and secondary coils are wound on a laminated core, the whole being immersed in oil. The weight of the iron in the magnetic circuit is 700 pounds, and the weight of copper is 45 pounds in the primary and 60 pounds in the secondary coils. The tank containing the oil is of wood, lined with metal. The two terminals of the secondary coil rise out of the oil to a height of two feet above the top of the tank, as seen in Fig. 1. These terminals placed 32 in. apart are surrounded by standards heavily insulated with paper boiled in paraffine. The wires emerge from glass insulators which cap the paper insulation. After leaving the insulated standards the current passes through heavy choke coils and then to the terminals proper. As usually operated, a heavy glass plate is placed between the two points, as seen in Fig. 1, but better shown in Fig. 2. The discharges leaping a maximum distance of 32 in., around this plate, are most fascinating, and, as can well be surmised, quickly assemble a crowd of visitors. The discharge between the two points is attended with a sharp crack when the arc is established. Smaller and frequent reports continue as long as the arc is sustained. These are due to the opening of shorter paths across the atmosphere when the main arc in its fantastic writhings assumes such a shape that the resistance of a short cut across the air is less than that of the long arc between the two points. More vehement displays are produced by leading the terminals to sheets of tin-foil on opposite sides of the large glass plate, as in Fig. 3, the discharges emerging from the edges of the tin-foil in great numbers, and passing over the edges of the plate. The noises accompanying such discharges can be heard in all the neighboring section of the building, even above the constant hum of the machinery.

For varying the voltage of the transformer a regulator is provided. This consists of a transformer with a ratio of one to one, whose primary is connected to the Exposition mains. The secondary coil is movable and by operating a regulating wheel can be moved out of the main path of the magnetic flux of the transformer and the voltage so reduced.

This transformer was designed, built and shipped to the Exposition all within a period of six weeks. Of course, such rapid work would not have been possible on such an unusual and difficult piece of high-tension apparatus as a 500-volt transformer had Mr. Thordarson not made a study of and constructed such apparatus for some time previous, so that many of the numerous precautions necessary were known. But it is gratifying to know that the art of building extremely high-potential apparatus has progressed so far. The discharges which take place have no detrimental effect upon the transformer, thus proving that the maximum voltage for transmission is limited by the insulation of the line and not by that of the transformers.

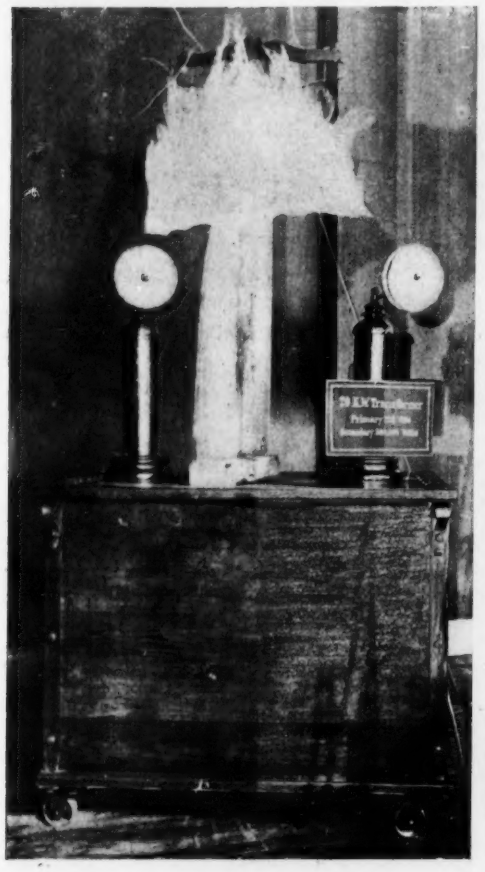


FIG. 1.—TRANSFORMER DISCHARGING THROUGH A 32-IN. GAP.

FIG. 2.—TRANSFORMER DISCHARGING THROUGH AND AROUND A HEAVY GLASS PLATE.

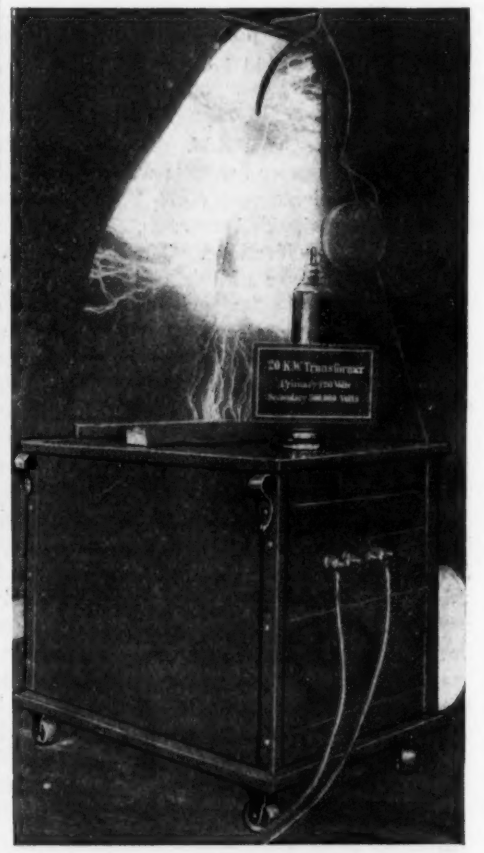


FIG. 3.—TRANSFORMER DISCHARGING BETWEEN SHEETS OF TINFOIL AROUND A GLASS PLATE.

Machine Tool Controllers.

The Ward Leonard Electric Company, of Bronxville, N. Y., has placed upon the market several new types of "machine tool controllers." They are for use with variable-speed, motor-driven machinery. Machine tool manufacturers have not provided space upon their machines for the ready mounting of a speed controller for motor drive. With this point in mind the Ward Leonard Electric Company has designed its "SKB" type of controller, the base of which is of such small dimensions that it can readily be mounted upon all types of machine tools. Fig. 1 shows its line of machine tool controllers. Its "SKB" controller is built up of standard stock parts, and very prompt shipment is, therefore, assured. If machines have sufficient mounting space, any of the other types shown may be used.

Fig. 2 shows the old method of mounting controlling apparatus before the types of controllers shown in cut No. 1 had been pro-

duced. All Ward Leonard machine tool controllers possess the following features:

1. Small, readily mounted upon machine tools. 2. Rust-proof, dust-proof. Short-circuits cannot occur due to metallic chips falling inside the box, etc. 3. The motor-starter is so interlocked with the field rheostat that the motor cannot be started under condition of weakened field. 4. The no-voltage release magnet is independent of the shunt field strength; therefore, the magnet does not release the starting arm when the motor field is weakened, to increase speed. 5. The overload device is a circuit-breaker, protecting the motor at all times, even during the period of starting. 6. A large number of steps in field rheostat for speed control.

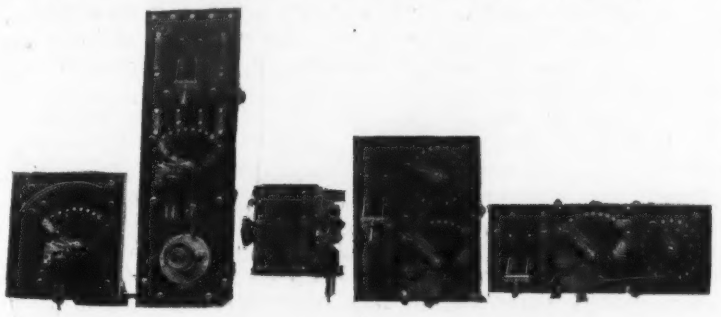


FIG. I.—TYPES OF MACHINE TOOL CONTROLLERS.

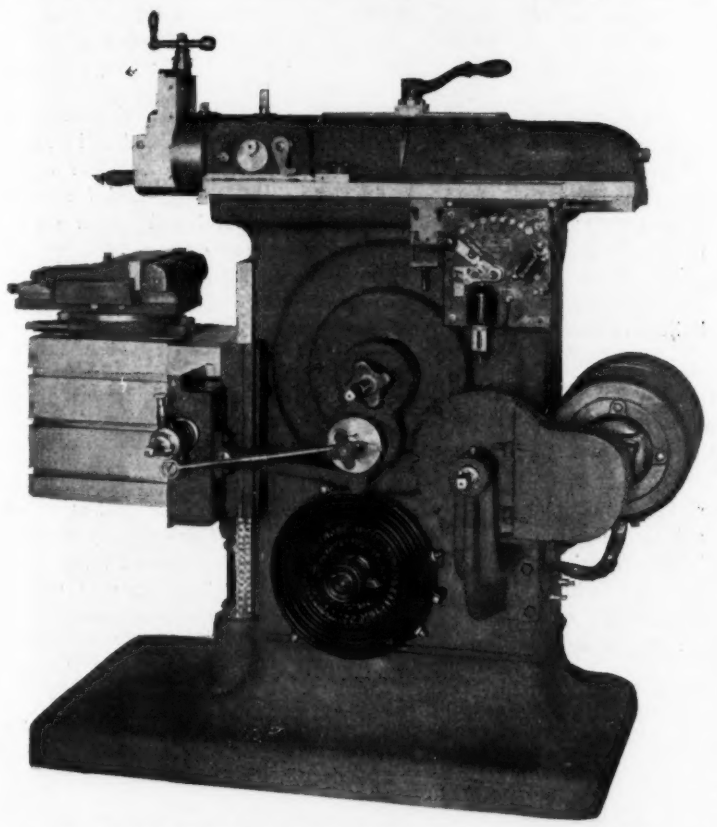


FIG. 2.—OLD METHOD OF MOUNTING CONTROLLING APPARATUS.

New System for the Care of Standard Instruments.

It has seemed to the Westinghouse Electric & Manufacturing Company that the principal reason why the standard instruments in general use are not periodically checked is that no establishment which is properly equipped for standardization is in a position to handle the work upon a basis suited to commercial conditions. This company has found it necessary to equip a Department of Standards in order to secure the service it requires in the production of its instruments, and the contrast between the closely-maintained accuracy of the checking instruments calibrated by its Department of Standards and the general lack of uniformity prevailing among the checking instruments in central stations is constantly made apparent. It was, therefore, only natural that when this company produced a line of instruments of precision, in the continual accuracy of which it had an active interest, that it should place the facilities of its Department of Standards at the service of owners of these instruments and encourage their periodical checking by eliminating all questions of delay and expense.

As ordinarily sold, all direct connection between the manufacturer and the instruments ceases when they are shipped to their purchasers. With the Westinghouse plan an active interest is maintained in the instruments for the entire period covered by the period of free calibration (five years) and at intervals of greater or less frequency during this time the manufacturer reassumes a responsibility for its accuracy by checking its performance and certifying to its accuracy.

To encourage periodical checking, the Westinghouse Electric & Manufacturing Company guarantees that there shall be no delay in the examination of instruments by its Department of Standards, and that they shall be promptly checked and restored to their owners. Unless repairs are necessary, there will thus only be a very few days in which the owner will be deprived of the use of the standards, and it will ordinarily be possible for him to send them away and get them back without any inconvenience because of their absence.

In addition to the benefits derived from having instruments checked continuously by the same standardizing department, there is a general advantage in having the same service as nearly universal as possible, particularly if that service gives a higher degree of security in the trueness of electrical measurements than can be gained by patronizing various establishments. It must be acknowledged that if perfect instruments could be furnished to all users and their accuracy maintained continuously by reference to a single set of standards of undoubted reliability, an ideal condition would prevail uniformly throughout the electrical field. It is this condition that the Westinghouse Electric & Manufacturing Company is endeavoring to produce so far as perfection may be attained under commercial conditions.

National Battery Company.

There are only a few manufacturers of electric storage batteries in this country, but of the number the National Battery Company, of Buffalo, N. Y., is one of the most active. The history of this factory is unique. It was originally part of the American Bicycle Company, which later became the Pope Manufacturing Company, and from them the entire capital stock has been purchased by individuals, who are, at the present time, not only extending the already large factory buildings, but so improving the interior arrangements that all the manufacturing methods and systems will be thoroughly up-to-date. Electric elevators, trolley car lines, etc., will equip the factory, carrying the heavy product handled rapidly from place to place. The chemical and electrical laboratories have been greatly increased in size, and are being equipped with the very latest types in every variety of instrument required for experimental work. The spirit of the new ownership and management is bold and aggressive, having at its command all the capital and resources that will be required to make the company a success, and it is pushing on as rapidly as it is possible to go.

The largest product of the factory is batteries for power plants and various kinds of stationary work. After this the railroad and telephone batteries are the important product. For the manufacture of automobile storage batteries, separate departments have been made, so that as the volume of this work rises and falls, according to the season of the year, the factory output will be fairly well able to take care of the demand, and yet not interfere with the more continuous and larger volume of business in stationary power batteries.

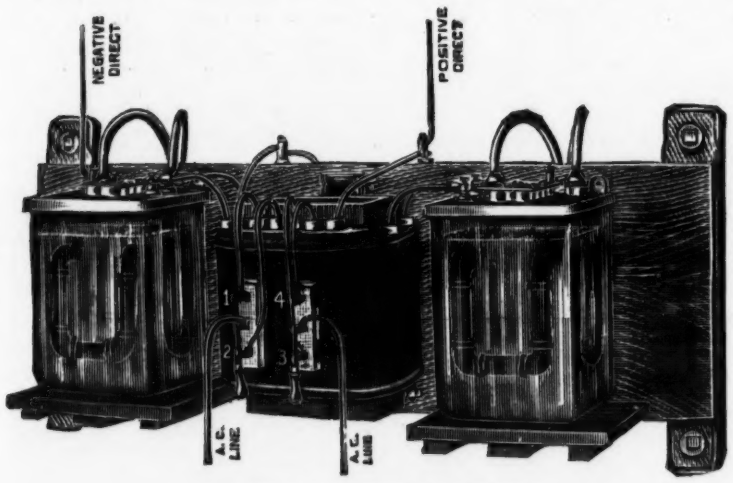
The space to be built upon is 111 ft. on Massachusetts Avenue, adjoining the present factory, and has a depth of 500 ft. parallel with Winter Street. A two-story wing, extending north from the main factory, 52 ft. wide and 144 ft. long, parallel with Lawrence Place, will increase the size of the present forming rooms. These two new buildings form a court in the center of the property, and permit of still greater extensions on the north and east. We are told that large contracts have recently been taken, and the whole factory is alive with activity. The organization includes the president, whose offices are at 253 Broadway (Postal Telegraph Building), New

York; the vice-president, who is general manager, and his assistant; the treasurer, the chief engineer and the chief chemist, with their corps of assistants.

Aluminum Alternating-Current Rectifier.

Due to the fact that aluminum possesses the property of developing upon its surface an insulating film when in contact with certain solutions and while electrically positive to another electrode in the same solution, many attempts have been made to produce a commercial rectifier based upon this property. A single cell with a pair of suitable elements will rectify part of the cycle of an alternating current. The current produced, however, is not unidirectional, but is an alternating current with the positive wave of greater amplitude than the negative. A true unidirectional current may be produced by a combination of four rectifying cells. With this method the efficiency is necessarily low, because of the fact that the resistance in the path of the useful current is double that of a single rectifier.

A type of rectifier which overcomes these difficulties is the "Churcher," which rectifies both waves of any alternating current, and requires but one jar, one solution and one set of electrodes. This form of rectifier embodies the use of a transformer with a secondary of twice the direct-current voltage required plus the resistance loss. This secondary coil is tapped at the center and by virtue of the action of the rectifier this tap remains positive at all times to one or



ALTERNATING-CURRENT RECTIFIER.

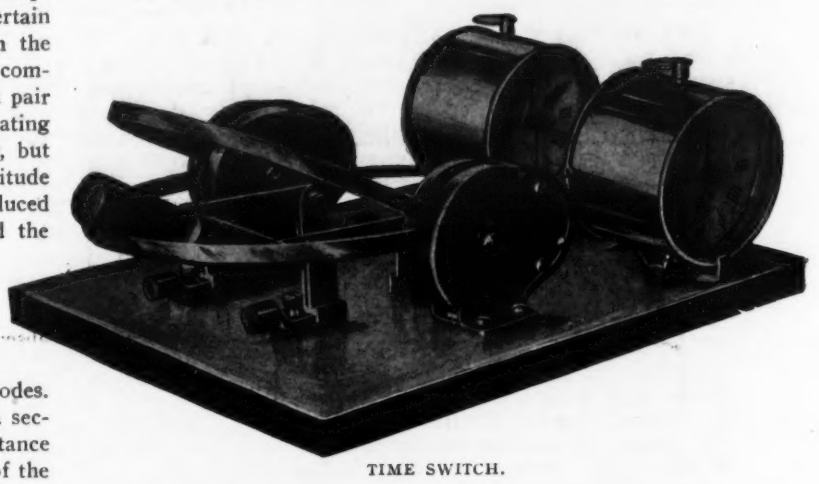
the other extreme terminals. The active electrodes are attached to each of the extreme secondary terminals, the number depending upon the phase of the alternating supply. Between these active electrodes, but insulated from them, is placed an inactive electrode, preferably of platinum. Connected between this electrode as one terminal and the center tap of the transformer as the other is the battery to be charged or the direct-current motor to be operated. The current passes from the center tap of the transformer to the motor, from the motor to the inactive electrode in the rectifier solution, to one or the other electrodes, depending on which is at that instant negative to the center of the transformer.

The practical limit of e.m.f. of one cell of the Churcher rectifier is about 50 volts direct current at full load, or a difference of potential across the active electrode of about 130 volts. Through the use of two cells and two secondaries in the one transformer twice the voltage can be obtained. Three cells with three secondaries in the one transformer will give three times the voltage, so that a proper system of rectifier will deliver almost any potential of direct current from any alternating-current circuit.

As will be seen from the cut, the rectifier requires no wiring other than the two wires leading to it from the alternating line and the two wires delivering the direct current. The rectifier being mounted on a board and attached to the wall, it occupies space which is of little use for any other purpose. The chemicals used are cheap and are readily obtainable at any drug store, and being entirely harmless, the operator is subject to no danger on account of their use. The manufacturer of this device is the Electrical Appliance Company, of Cincinnati, Ohio.

Crescent Time Switch.

The accompanying illustration shows a new device for automatically opening at a predetermined time the lighting circuits for halls, signs and show windows. The switch is of the quick-break type, and its action eliminates all the arc and flash accompanying the opening by hand of the ordinary knife switch. The device is exceedingly simple, is constructed of few parts and is controlled by



TIME SWITCH.

means of a specially-made 24-hour clock. The controlling clock is in contact with only the handle portion of the switch, thus insuring proper insulation of the clock from the power circuits. For opening the circuit to hall lights in apartment buildings and for other similar service, a special device has been developed which serves merely to extinguish the lights at the proper time.

The Crescent Company, 134 Van Buren Street, Chicago, the manufacturer of this device, has issued an attractive and comprehensive bulletin, No. 205, which describes it in detail.

Punched Clip Knife Switches.

To meet the demand for well-made switches for motor or lighting service in factories or similar installations, and to be sold at a low price, the General Incandescent Arc Light Company, 529 West Thirty-fourth Street, New York, has designed a line of lever knife switches, which are now being furnished in sizes from 15 to 150 amp., single or double-throw, 1, 2 or 3-pole, for 250-volt service.

As will be seen from the engraving, they are front-connected,

CLIP KNIFE SWITCHES.

mounted on a slate base, and are well made in every particular, all conducting parts being of pure rolled copper finished by dipping and lacquering. They are designed to meet the underwriters' requirements, and should be found entirely satisfactory in every case, excepting where a highly-polished switch is required.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—The stock market showed a tendency to recede during the early part of the week, but gained strength on the appearance of the Government crop report. The Southern stocks and those of the corn-carrying roads, together with Metropolitan Traction, were strong. United States Steel issues were quiet, pending the outcome of the reports of cutting of steel prices. Metropolitan Securities and Metropolitan Street Railway advanced on further talk of a deal with the subway interests. The lowest quotation of the latter stock was 118¾ and the highest 125¾. Trading sagged and the price fell to 123¼, which was the closing quotation and a net gain of 4¼ points. Of this stock 218,300 shares were sold. Brooklyn Rapid Transit was also actively traded in, 125,200 shares having been sold at prices ranging from 51¼ to 54½. The closing price was 54⅜, a net gain of 2¾ points. Allis-Chalmers common closed at 11½ and preferred at 50, the former being a net increase of ½ a point and the latter a net loss of 1 point. General Electric made a net gain of 1¼, closing at 164, which was also the highest price of the week. Westinghouse closed at 159, a gain of ½; Western Union, 89, a gain of ⅝, and American Telegraph & Telephone, 139⅜. The prices for outside securities were higher for most issues. Following are the closing quotations of August 16 except Boston, where it was Grand Army week:

NEW YORK

	Aug. 9	Aug. 16		Aug. 9	Aug. 16
Allis-Chalmers Co.	11	11	Electric Vehicle	9	9
Allis-Chalmers Co. pfd.	48	47	Electric Vehicle pfd.	14	13
American Tel. & Cable.	90	89	General Electric.	163¼	164
American Tel. & Tel.	139	138	Hudson River Tel.	..	..
American Dist. Tel.	22	22	Metropolitan St. Ry.	123¼	123⅞
Brooklyn Rapid Transit.	53	53⅜	N. Y. & N. J. Tel.	152	151
Commercial Cable.	186	181	Marconi Tel.	..	..
Electric Boat.	39	39	Western Union Tel.	89	89
Electric Boat pfd.	66	65	Westinghouse com.	159	159¼
Electric Lead Reduction.	1	⅛	Westinghouse pfd.	..	165

BOSTON

	Aug. 9	Aug. 16		Aug. 9	Aug. 16
American Tel. & Tel.	139⅛	..	Western Tel. & Tel. pfd.	92	..
Cumberland Telephone.	118	..	Mexican Telephone.	..	..
Edison Elec. Illum.	259	..	New England Telephone.	124	..
General Electric.	163	..	Mass. Elec. Ry.	17⅛	..
Western Tel. & Tel.	14	..	Mass. Elec Ry. pfd.	..	..

PHILADELPHIA.

	Aug. 9	Aug. 16		Aug. 9	Aug. 1
American Railways.	47⅝	49	Phila. Traction.	98¾	98¾
Elec. Storage Battery.	..	60	Phila. Electric.	6⅝	6¼
Elec. Storage Battery pfd.	..	60	Phila. Rapid Trans.	..	12¾
Elec. Co. of America.	9	9⅜			

CHICAGO

	Aug. 9	Aug. 16		Aug. 9	Aug. 16
Central Union Tel.	..	..	National Carbon pfd.	..	107
Chicago Edison.	..	143	Metropolitan Elev. com.	19	18⅛
Chicago City Ry.	..	170	Union Traction.	..	4⅛
Chicago Tel. Co.	..	120	Union Traction pfd.	..	26
National Carbon.	33	34			

METROPOLITAN SECURITIES COMPANY.—Heavy trading in Metropolitan Street Railway and Metropolitan Securities shares has led many to ask what the Metropolitan Securities Company of New York really is, and just what relation it bears to the Metropolitan Street Railway. There is still another link in the chain—the Interurban Street Railway Company, which joins the two Metropolitan companies. The name of the Interurban Company was last year changed to the New York Street Railway Company, to avoid its being confused with that of the Interborough Rapid Transit Company. The Metropolitan Securities Company, which has a capital of $30,000,000, was organized first to raise funds to take up the Metropolitan Street Railway's floating debt and afford resources for future requirements, and second to permit of controlling the surface lines with comparatively small capital. The Securities Company undertook to furnish the railway with $23,400,000 fresh money, which was given the latter through the medium of the Interurban Street Railway, receiving in return all the capital stock of the Interurban Company, and, with other assets, $11,000,000 4 per cent. Metropolitan refunding bonds. The company leased Metropolitan Street Railway at a guarantee of 7 per cent. dividends. Metropolitan Securities is nothing more than a holding company, but it has extensive rights under a charter which runs for a thousand years.

HARTFORD (CONN.) LIGHTING GROWTH.—The directors of the Hartford Electric Light Company have voted to recommend to the stockholders that the captital stock of the corporation be increased $200,000. There is no doubt that the recommendation will be adopted. The present capitalization is $1,400,000. The new shares will be offered at par to the stockholders at the ratio of one share of new to each seven shares of old. As the company's stock has a market quotation of about $240 a share at the present time the rights in the new issue will be valuable. The funds derived from the sale of the new stock will be devoted to the erection of a new power plant on the Connecticut River at the place known as Dutch Point.

INTERBOROUGH EARNINGS.—Subjoined is the twelve months' statement of the New York Interborough Rapid Transit Company, which owns both the Manhattan Elevated system and the new Subway:

Twelve months gross	$14,187,684	$12,208,337	Inc.	$1,979,347
Expenses	5,846,052	5,460,794	Inc.	385,258
Twelve months net	$8,341,632	$6,747,543	Inc.	$1,594,089
Other income	341,504	346,859	Dec.	5,355
Total income	$8,683,136	$7,094,402	Inc.	$1,588,734
Charges	6,757,412	2,820,859	Inc.	3,936,553
Surplus	$1,925,724	$4,273,543	Dec.	$2,347,819

UNITED STATES CARBON.—The announcement is made by the Guardian Trust Company, of Cleveland, Ohio, that it has bought of the Federal Trust Company, for a nominal amount, $100,000 of bonds of the United States Carbon Company. They were held as collateral for a loan by the Federal. The interest on the note was not paid and the effort of the Federal Trust Company was to realize. The sale was made to the Guardian Trust Company, at once the assignee and the absorber of the Federal Trust Company. Mr. Mosher, the secretary and treasurer of the Guardian Trust, says that the next step will be to foreclose and bring about a sale of the property.

STATUS OF AMERICAN MARCONI.—The American Marconi is now operating entirely commercially. Of the Atlantic steamers, forty-four are already fitted with Marconi instruments, and on five steamers the installation of the Marconi apparatus is under way. The company is operating commercially four stations in the United States, ten in England, six in Canada and two on the German coast. Through its wireless service there has been published daily the "Cunard Bulletins" on board the Cunard line steamers. In addition, between sixty and seventy vessels of the English navy are equipped with Marconi instruments. In Italy the development has been considerable.

TELEPHONE ACTIVITY.—An officer of the Bell Telephone Company, of Philadelphia, says: "The increase of business as against 1903, so far, although not as great as our gains in 1903 as compared with 1902, is satisfactory. Our gross calls for 1904 up to date are 25 per cent. to 30 per cent. greater than those in the corresponding period of 1903. Both gross and net profits for July, as well as for the six months ended June 30, 1904, will show about 20 per cent. increase over the same periods of 1903. I understand that the decrease in gains in telephone business, comparing 1904 with 1903, and 1903 with 1902, has been greater in other parts of the country than in Philadelphia."

ALBANY AND TROY TRACTION.—The United Traction Company of Albany and Troy reports for the year ending June 30 gross earnings of $1,690,205 and net earnings of $588,343, as compared with $529,243 net in 1903. The company has capital stock issued of $4,999,950 and a funded debt of $5,141,000. The number of passengers carried during the year, including transfers, was 32,429,071; transfers, 3,302,850. The company owns 212 box cars, 158 open cars, 7 express cars, 10 service cars, 13 snowplows and 9 scrapers. The average number of employes, including officers, was 1,200 and the salaries and wages paid them amounted to $713,226.63.

THE EUROPEAN DE FOREST WIRELESS COMPANY syndicate is being completed. The company is an English corporation with a capital of £200,000, divided into 200,000 shares of £1 each. It will operate under the De Forest patents, for which the American company is to receive a large cash and share consideration. The syndicate will start with a working capital of £50,000. Its board, to be announced soon, is composed of some of the most prominent English names. Mr. F. Z. Maguire, well known in electrical circles on both sides of the Atlantic, is organizing matters in England.

BONDS FOR CHICAGO ELEVATED.—Stockholders of South Side Elevated, Chicago, have authorized an issue of $8,000,000 4½ per cent. bonds to build the Englewood extensions. Of this amount $3,000,000 will be issued at once and offered to stockholders at par. The new bonds have been placed with the Illinois Trust & Savings Bank.

PACIFIC STATES TELEPHONE.—The Pacific States Telephone & Telegraph Company has increased its dividend rate from 6 to 7 per cent. The capital stock of the company is $13,000,000, of which the American Telephone & Telegraph Company, according to its last statement, owns $6,012,200. The Pacific States Company reports for the five months ended May 31:

	1904.	1903.	Increase.
Exchange service	$2,078,010	$1,853,537	$224,473
Toll service	606,223	580,029	26,194
Miscellaneous	52,380	51,879	501
Total income	$2,736,614	$2,485,446	$251,168
Expenses	1,930,380	1,918,535	11,845
Profits	$806,234	$566,911	$239,323

PUGET SOUND POWER.—Stone & Webster, of Boston, have received advices from their representatives in Tacoma of the starting up of the final unit of the water power plant on the Puyallup River, Washington. The Puget Sound Power Company has thus completed the 20,000 hp development which was begun in February, 1903, and this power is now supplied to the Seattle Electric Company, the Tacoma Railway & Power Company and the Puget Sound Electric Railway; $3,000,000 of the $4,000,000 authorized 5 per cent., 30-year gold bonds for the Puget Sound Company (guaranteed by the Seattle Electric Company) were taken by Boston bankers.. The remaining $1,000,000 will be issued as required, at the rate of one $1,000 bond for every $1,250 expended for additions and improvements.

CUMBERLAND TELEPHONE EARNINGS.—The following are the June month earnings reported by the Cumberland (Bell) Telephone & Telegraph Company:

	1904.	1903.	Changes.
June gross	$329,962	$287,198	Inc. $42,764
Expenses	202,766	174,298	Inc. 28,468
June net	$127,196	$112,900	Inc. $14,296
Charges	21,862	22,593	Dec. 731
June surplus	$105,334	$90,307	Inc. $15,027

CONNECTICUT RAILWAY & LIGHT reports as follows for the year ended June 30:

	1904. (Partly est.)	1903. (Actual.)	1902. (Actual).
Gross	$1,893,038	$1,228,633	$1,274,821
Expenses	1,284,920	819,091	668,454
Net	$608,118	$409,542	$606,367
Charges	561,783	527,905	518,553
Surplus	$46,335	Def.$118,363	$87,814

Gross earnings from January 1 to May 31, 1904, were $594,357, against $731,909 for the same period of 1903.

LARGE TRACTION MORTGAGE.—Walter C. Nelson, president of the Northern Traction Company, has filed at South Bend, Ind., a mortgage of $3,500,000 to the Knickerbocker Trust Company of New York and Benjamin L. Allen, New York, co-trustees. The mortgage covers a proposed electric car line to extend from South Bend to Chicago through New Carlisle, La Porte, Valparaiso and Hammond, Ind.

ATLANTA, GA., EARNINGS.—For the year ended June 30, 1904, the Georgia Railway & Electric Company earned gross, $1,971,891; net, after interest and taxes, $383,970, which amounts to 5 per cent. upon the outstanding $2,400,000 preferred stock and 4¼ per cent. upon the $6,014,600 of common stock.

TELEPHONE RECEIVERSHIP.—The application of the Territorial Loan & Trust Company, of Muskegee, I. T., for the receivership of the Commercial Telephone Company, an independent long-distance telephone system in southeast and central Texas, has been granted.

DIVIDENDS.—A dividend of 2½ per cent. has been declared on the preferred stock of the Scranton Railway Company, payable September 1. The New England Telephone & Telegraph Company has declared the regular quarterly dividend of $1.50 per share. The Pennsylvania Telephone Company has declared a quarterly dividend of 1½ per cent.

ST. JOSEPH (MO.) LIGHTING BONDS.—Sealed bids will be received until August 18 for the following 4 per cent. 20-year coupon bonds, aggregating $325,000; electric light, $75,000; sewer, $250,000. ing here and the *Ledger* building in Philadelphia.

ALLEGHENY (PA.) LIGHTING BONDS.—An issue of $40,000 4 per cent. 5-14-year (serial) electric light bonds for the municipal plant has been sold to the sinking fund commission at 100.

Commercial Intelligence.

THE WEEK IN TRADE.—The state of general trade is favorable. In iron and steel the conditions are favorable, while in the lesser metal markets there has been a steadiness in prices, with considerable copper placed with American consumers. Export business, however, was comparatively light. It is stated that large orders were placed at prices below the market rates, but on the surface there are no indications of any important changes. The recently issued Government crop reports are, in the main, favorable, and earlier prospects of a large cotton yield have not materially changed. The best trade advices come from Chicago and leading Southwestern cities, and in the South jobbing trade tends to improve. Good reports come from the structural steel trade, where a large business is reported developing. *Bradstreet's* reports 167 business failures during the week ending August 11, as compared with 179 the week previous.

A ROCKEFELLER INSTITUTE.—Plans have been filed in New York City for a laboratory building for the Rockefeller Institute for Medical Research. The building will be erected at the southwest corner of Sixty-seventh and exterior streets. It will be five stories. It will have a frontage of 136 feet and a depth of 60 feet. Its facade will be of limestone and brick, decorated with pilasters of brick. There will be a porch entrance flanked with decorative columns for the support of electric lights. The first floor will be fitted as an assembly hall, with a library and study, and also a room for the directors. The upper floors will contain a series of large general and special laboratories and research rooms. The fifth floor will contain a dining hall and living quarters. On the roof will be a special operating room and quarters for the animals under examination. Adjoining the main building will be a two-story building. In part of this building will be pens for animals used by the physicians. The heat and electric plants of the institute will also be in that building. The cost of the building is estimated at $325,000. The architects are Shepley, Ruttan & Coolidge, of Boston. The power house will supply steam and electric power for the other buildings. It will be of brick, one story in height, 38 feet front and 57 feet in depth.

UTILIZING WAVE POWER.—A number of well-known public men are interested in a new company to exploit certain new water power inventions of William L. Water, of Pontiac, Mich., comprising a current motor, a combination tide motor, a wave motor and a hydraulic motor. The corporation has been organized under the laws of the District of Columbia. Hopewell H. Darneille, assessor of the District of Columbia, is president, and Representative Samuel W. Smith, of Michigan, is first vice-president. Among the trustees are Senator Jacob H. Gallinger, of New Hampshire; Speaker Joseph Cannon, of Illinois; former Representative Charles F. Joy, of Missouri; Lieutenant Commander Frank W. Bartlett, U. S. N.; former Representative Edgar Weeks, of Michigan; Major Henry L. Biscoe, of Washington, and Tompkins C. Delavan, of New York. The invention is one by which, it is asserted, power can be obtained at any point where there is an ocean, a river, or even a small stream. The motor, it is declared, may be mounted between scows anchored in the stream, with machinery housed on deck. It may be placed on a flatboat anchored in the stream or installed in a flume constructed alongside the stream, fed from dam or canal and housed as any power plant.

GEORGE BENDER, 137 Centre Street, New York, reports a brisk demand for high-grade, second-hand dynamos and motors. Among recent sales are a 30-kw, 125-volt Bullock generator to the Carnegie Steel Company, Youngstown, Ohio; a 30-hp Westinghouse 2-phase motor to the Vehicle Equipment Company, Brooklyn; a 25-kw, 230-volt generator and a 15-hp, 230-volt motor to E. Miller's Sons, Long Island City; a 7½-hp Westinghouse motor to the Cupples Envelope Company, New York; a 5-hp Westinghouse motor to John J. Fox, Tremont, N. Y.; a 10-hp motor to Irving Iron Works, Long Island City, and a 10-hp Westinghouse motor to Hawkins Iron Works, Long Island City. He also reports a good demand for small motors around New York City for running sewing machines, printing presses, etc.

THE SPRAGUE ELECTRIC COMPANY has for many years been identified with the manufacture and installation of electric motors for operating ventilating fans and blowers. Their motors are particularly well adapted to this class of service. Among recent installations are the motors to drive the ventilating apparatus in the Chicago Post Office and the New York City and Brooklyn public baths. In the West Forty-first Street and East Seventy-sixth Street public baths there will also be installed two 30 and two 25-kw Sprague engine type generators.

ANOTHER BIG MEXICAN TRANSMISSION.—Advices to hand from Guadalajara, State of Jalisco, state that the company which holds what is known as the Perez concession, which permits of the utilization of water power from the Santiago River, State of Jalisco, proposes to transmit electrical energy to the city of Agua Calientes. The distance is about 110 miles. The length of river covered by the franchise is about 30 miles. The available fall is about 700 ft. It is estimated that no less than 30,000 hp can be developed. W. A. Rogers, of New York, is one of the owners of the concession. J. M. Garcia, Lazaro Lepetich and Latour de Vasquez, all of Guadalajara, are also primarily interested in the enterprise, which at the moment is the most important power transmission project in the southern republic outside the well-known Necaxa-Mexico City-El Oro scheme. Mr. Rogers is at present in Guadalajara. His address is Post Office Box 245. While here he makes his headquarters at the offices of Mr. H. P. Layton in the Hudson Building, 32 Broadway.

ANDERS PUSH BUTTON TELEPHONE COMPANY.—A petition in bankruptcy has been filed against the Anders Push Button Telephone Company, of 136 Liberty Street, New York City, by Henry W. Sykes, for the following creditors: William J. Murdock & Co., $1,022; Edwards & Co., $124, and the Business Address Company, $11. It was alleged that it is insolvent and has transferred portions of its property to certain creditors to prefer them. The company was incorporated on November 21, 1901, as the American Push Button Telephone Company, with a capital stock of $300,000, and the name was changed to the present style in May last. Considerable money was spent on developing the instruments of the company. Mr. Sykes said the liabilities exceed $15,000. The assets consisted of stock, materials, machinery and fixtures, $4,500; outstanding accounts, $2,000, and patents, value unknown. On June 22 the company gave a mortgage on all its property for $5,000 to Thomas J. Crary, and assigned patents to him on February 10.

AMERICANS ACQUIRE MANILA LIGHTING PLANT.—The Manila Electric Railway & Light Company, Limited, which American capitalized concern is constructing an extensive electric traction system in and around Manila, Philippine Islands, has just purchased La Electricista Compania Anonima, the Spanish capitalized concern, which operates the only electric lighting system in Manila. The present franchise holds good until 1917, after which time it can be renewed for a period of 10 years if the tender submitted is the lowest. It is understood that it has not yet been determined upon by the new interests whether the existing lighting plant will be remodeled or if power is to be derived from the central station, which will also generate energy for operating the electric traction system now being hastened to completion by the contractors, J. G. White & Co., 43-49 Exchange Place.

FUSE EQUIPMENT FOR SUBWAY.—In addition to furnishing the entire fuse equipment of the Manhattan Elevated Railway, the D. & W. Fuse Company, of Providence, R. I., now reports that so satisfactory have been the cut-outs and fuses on this equipment that it has been favored with the contract for furnishing the entire fuse equipment for the Subway Rapid Transit Company, which is also a part of the Interborough Rapid Transit Company's system. This order was also secured on merit, as the engineers of the subway division have been making further tests on their own account of these large capacity fuses. The company was called upon to submit fuses as large as 800 amp. to be tested on a dead-short circuit, and the samples proved capable of fulfilling all of the conditions imposed upon them.

EQUIPMENT FOR OLD *TIMES* BUILDING.—Mr. P. Potrykus, the electrical engineer and contractor for the installation of additional machinery in the old *Times* Building, Park Row, New York, has placed an order with the General Electric Company for the generator, while the Ball & Wood Company will build the engine. The outfit will have a capacity of 150 kw. The Trumbull Electric Company, 136 Liberty Street, will supply the switchboard, panel and distributing boards, etc. The entire building will be rewired. This work will be carried out by the Clifton Manufacturing Company, of 308 West Street.

SYSTEM FOR IXTLAN DEL RIO.—The Mexican electrical engineering and contracting firm of Ugarte & Garcia, of Guadalajara, State of Jalisco, has secured a contract from the municipal authorities of Ixtlan del Rio, State of Jalisco, for the installation of a fair-sized electric lighting and power system. The initial plant will be a steam one, but it is the intention of the contractors to secure power ultimately from the Falls of Elojo de Agua, about 40 miles from Ixtlan del Rio. All the necessary equipment will be purchased in the United States.

EQUIPMENT FOR HOSPITAL.—Considerable electrical equipment is to be installed in the new hospital to be built at Fordham, N. Y. The boiler capacity will be upward of 1,500 hp, as it is intended to put in three units of 525 hp each. The electrical machinery will be capable of generating about 500 kw. The generators will range in capacity from 50 kw to 125 kw. The engines will be tandem-compound, high-speed, horizontal, automatic cut-off. Mr. Frank Sutton, Tontine Building, is consulting electrical engineer on the work.

EQUIPMENT FOR NEW JERSEY STEEL PLANT.—The Steel Company of America, which has been incorporated in New Jersey, and is understood to be backed by prominent New York and Pennsylvania capitalists, is to build an extensive plant in Harrison, N. J., and employ electricity on a large scale for its operation. Mr. Charles Howard Williams, of 31 Nassau Street, is the only known representative at the moment of the principals in the enterprise.

EQUIPMENT FOR BOSTON STORE.—The $3,000,000 department store, which is to be constructed in Boston by the Department Store Trust Company and leased to Mr. Henry Siegel, will have quite a large lighting equipment. The contract for the construction of the building has been awarded to the George A. Fuller Company, of 135 Broadway, New York. The services of Mr. H. Alexander, electrical engineer, of 20 West Thirty-fourth Street, have been retained.

MACHINERY FOR MOUNT VERNON PLANT.—The plant which furnishes power to operate the shops of the Mauser Manufacturing Company and the Max Arms Machine Company, at Mount Vernon, N. Y., is to be enlarged. The generators at present installed are of Crocker-Wheeler build. The engines are Skinner machines. The two shops are to have more motors.

JALISCO LIGHTING AND POWER SCHEME.—Mexican advices state that Amelio Reyes, of Guanadalajara, State of Jalisco, has entered into an agreement with the municipal authorities of Ameca for the purpose of constructing an electric lighting and power plant in that place. Mr. Reyes controls a large alcohol factory in Ameca, which will be electrically operated.

GENERAL ELECTRIC GENERATORS FOR ROCHESTER STORES.—The generators—three of 100-kw capacity each—to be installed in the big department store under construction at Rochester, N. Y., by Burke, Fitzsimons, Hone & Co., are to be built by the General Electric Company. The engines, direct-connected, will be of Harrisburg make.

EQUIPMENT FOR GOUVERNEUR HOSPITAL.—An additional plant is to be installed in the Gouverneur Slip Hospital, New York, for supplying light and power for the new extension of the building. The general contractors are John R. Sheehan & Co., of 160 Fifth Avenue. Mr. Frank Sutton, 81 Wall Street, is to act as electrical expert.

PLANT FOR BAUGH CHEMICAL WORKS.—The Baugh Chemical Company, of Baltimore, Md., is about to add to its electrical equipment and has ordered a 150-hp Harrisburg-Fleming side-crank engine to be direct-connected to a General Electric generator of 100-kw capacity. The machinery is to be utilized for both light and power.

A LARGE ARC LAMP ORDER.—The General Incandescent Arc Light Company, 529 West Thirty-fourth Street, New York City, has been awarded the contract for a large quantity of G. I. arc lamps (110 volts d. c.) for John Wanamaker's new New York store. There appears to have been considerable competition for this order.

MACHINERY FOR NEWARK TOOL SHOPS.—More lighting and power equipment is to go in the Newark (N. J.) shops of Gould & Eberhardt, manufacturers of machine tools. The Manufacturers' Construction Company, of Wilmington, Del., has the contract for building.

CABLES FOR BRIGHTON, ENGLAND.—The contract for the cables for the extension of the electric lighting system at Brighton, in the south of England, has been secured, according to reports, by Siemens Bros. & Co., of London. The accepted tender was £39,420.

MOTORS FOR DOMINICK & HAFF.—A number of additional motors are to be installed in the West Twenty-third Street factory of Dominick & Haff, manufacturing jewelers, where some 200 hp of Crocker-Wheeler build are already in operation.

WIRE TUNNELS FOR CHICAGO.—The Western Union Telegraph Company, the Postal Telegraph & Cable Company, the Chicago Telephone Company and the Edison Electric Company, which have small tunnels in the Washington and La Salle Street tunnels, have notified the city officials that when the tunnel lowering begins they will individually construct new tunnels.

MILWAUKEE ELECTRIC RAILWAY & LIGHT COMPANY has taken out a permit to erect a $100,000 addition to its Commerce Street plant. The addition will be four stories high, 83 x 144 ft.

THE GENERAL ELECTRIC COMPANY has secured the contract for an electric light plant for Newberry, S. C. for $5,905.

General News.

THE TELEPHONE.

HUNTSVILLE, ALA.—The planters in the Green Grove neighborhood have organized a company with $2000 capital to furnish themselves telephone connection with this city.

COLUMBIANA, ALA.—The White-Davis Telephone Company, of Columbiana, Shelby County, has been formed. Capital, $10,000. The incorporators are J. R. and W. P. White and W. F. and N. Davis.

BIRMINGHAM, ALA.—The People's Home Telephone Company has ordered the equipment for four new trunk lines, which will be stretched between Bessemer and Birmingham, giving to the company nine lines into Birmingham.

JONESBORO, ARK.—The Southwestern Telephone Company will spend $5000 on improvements on its line.

SANTA ROSA, CAL.—The Two Rock Valley Telephone system is about ready to commence operations.

SAN PEDRO, CAL.—It is estimated that within six months the Home Telephone Company will have a system complete in San Pedro.

PETALUMA, CAL.—The Vallejo Township Telephone Company has been formed by J. Caltoft, W. Evart, G. W. Ormsby and others. Capital, $5000.

HEALDSBURG, CAL.—Articles of incorporation of the West Side Telephone Company of Healdsburg have been filed. The directors are J. McClish, J. B. Wattles, S. E. Wattles, M. V. Frost, D. N. Goddard, A. D. Goddard and J. L. McClish. The company is incorporated for $6000.

SAN FRANCISCO, CAL.—The Automatic Direct Line Telephone Company of San Francisco, of which some prominent business men of this city are stockholders, has reorganized under the name of the Direct Line Telephone Company and has raised the capital stock from its former figures of $250,000 to $1,000,000.

SANTA ANA, CAL.—Bids will be received by the Board of Supervisors up to 10 a. m., Sept. 7. for purchase of a franchise to construct and maintain lines of telephone and telegraph in the county of Orange, California. A certified check for $50, together with a certified check for amount of bid for franchise, payable to order of the chairman of the board, is required with bid. Mr. C. D. Lester is the County Clerk.

REDDING, CAL.—Two telephone lines, both locally important, have been completed. The Redding, Ingot & Wengler Company made connections in Redding with the Sunset Company. Its line is fifty-five miles long, extending from Wengler on the big bend of the Pit to Redding, and passing through Round Mountain, Ingot, Bella Vista and Millville. The second line completed was one of eleven miles in Trinity County, connecting Minersville with Lewiston, and there making connection with the lines of the Sunset Company.

COCHRAN, GA.—The Southern Bell Telephone Company has purchased the local telephone system of this place from L. F. Blassingame, and will operate it after this date. The Bell already has a long distance office here.

VIRDEN, ILL.—The Kinloch Telephone Company is erecting poles through this city.

PEKIN, ILL.—The Washington Telephone Company is extending its line to Cooper.

REDDICK, ILL.—The Reddick Mutual Telephone Company certifies to an increase of capital stock to $5000.

McHENRY, ILL.—Work has been commenced on a new local telephone line between this place and Genoa Junction, Wis.

CHICAGO, ILL.—The Chicago Telephone Company installed 918 new instruments during July, and now has a total of 111,630.

FARMINGTON, ILL.—The Farmington Telephone Company has been incorporated by H. W. Connelly and others. Capital, $1000.

BELVIDERE, ILL.—The Boone County Rural Telephone Company has been formed, capital $25,000. Incorporators: Fred W. Plane, D. W. Barningham and H. S. Hicks.

BLOOMINGTON, ILL.—The Illinois Telephone Company of Jacksonville, an independent concern, has filed a certificate with the Secretary of State for an increase of capital stock from $10,000 to $500,000.

FREEPORT, ILL.—The Secretary of State has issued license of incorporation to the Cedarville-Stephenson County Telephone Company. The capital stock is $7000 and the incorporators are S. W. Roberts, S. F. Newhall and H. M. Fish.

ST. JOSEPH, ILL.—J. J. Woodin, of Louisiana, has returned to St. Joseph to put into operation a new telephone system for St. Joseph township. This system is backed by prominent residents of that township, and the owners will incorporate as the St. Joseph Telephone Company within a few days.

ROCKFORD, ILL.—The directors of the Rockford Home Telephone Company have voted to double the capacity of the local telephone exchange and to pay up the six per cent. bonds now outstanding against the company. The re-issuance of five per cent. bonds in greater number was voted as a substitute for the ones recalled.

BLOOMINGTON, ILL.—Preliminary plans to organize the Central Illinois Independent Telephone Association, which will represent a capitalization of over $10,000,000 and include every central Illinois independent telephone company, have been made in this city. Albert Schuler, of Streator, was chairman of the meeting and R. C. Critchfield, of Minier, secretary.

BLOOMINGTON, ILL.—The Central Union Telephone Company has been engaged for some time past in making improvements, additions and repairs on its system in the vicinity. A new copper line has just been completed between Bloomington and Gibson City and work will begin on a new copper line between Lincoln and Atlanta. Some time ago a new line was completed between Lexington and Chenoa to Gilman. Before the summer is over a copper line will be strung between Danvers and this city.

CYPRESS, IND.—The Cypress Telephone Company has been incorporated by J. A. Neale and others. Capital stock, $2000.

COUNCIL GROVE, KAN.—The Council Grove Telephone Company has been formed with $30,000 capital.

GALENA, KAN.—The Galena Home Telephone Company has been incorporated with a capital stock of $10,000.

ALMA, KAN.—The first dividend of the Wabaunsee County Telephone Company has been declared. The following officers have been elected: C. B. Henderson, president and manager; A. S. Allendorph, secretary, and J. B. Cassidy, treasurer.

KINSLEY, KAN.—The Kinsley Telephone Company has completed its line into Offerie and on the west to a point north of Bellefont, and is now waiting for the Dodge City line to connect with its line. The company is also installing several new telephones at Lewis which will be connected by switch with the toll line. Preparations are also being made to run a branch line up the river bottom. This line will be built as an experiment, the wire fences being utilized, insulators being used on each post.

NORVILLE, MICH.—The Norville & Manchester Telephone Company, capital $376, has been formed.

FREMONT, MICH.—The Dayton Central Telephone Company has been incorporated. Capital $2000.

WORDEN, MICH.—The Worden Farmers' Telephone Company has been formed, with $3000 capital, by J. H. Murray, J. Munn and N. Jarvis.

GRAND RAPIDS, MICH.—Secretary E. B. Fisher, of the Citizens' Telephone Company, announces that the new toll line of the company to White Cloud is now open and an exchange building will be erected at White Cloud. The new line connects the territory north of Newago with this city.

ALBERT LEA, MINN.—The Tri-State Telephone Company will build a line and continue it to Sioux Falls.

ST. PAUL, MINN.—An amendment to the articles of the Hutchinson Telephone Company increases its capital stock from $25,000 to $50,000.

ELK RIVER, MINN.—The Elk River Telephone Company has decided to extend its system into Wright County. The local company will also extend its wires into Nowthen, Anoka County.

SENATOBIA, MISS.—The Tate County Telephone Company has been incorporated with $1000 capital.

RALEIGH, MISS.—The Governor has approved the charter of incorporation of the Smith County Telephone Company, giving it the power to operate in all of the towns and villages of the county. The directors have secured the right of way over several public roads of the county.

JOPLIN, MO.—The central office of the Home Telephone Company has been connected up with an independent line to Kansas City. It is the first independent line ever built in Missouri more than 50 miles south of Kansas City.

MISSOULA, MONT.—The Rocky Mountain Bell Telephone Company will build a new exchange.

BLUE SPRINGS, NEB.—An exchange building is to be erected here for the Independent Telephone Company.

OMAHA, NEB.—The Union Pacific is installing its own telephone system. It will be under control of the Nebraska Telephone Company, and will be connected with the central exchange by fifteen trunk lines.

SYRACUSE, N. Y.—More than $200,000 will be expended in the erection and equipment of the building to be erected for the Central New York Telephone & Telegraph Company.

CHENANGO, N. Y.—The Castle Creek & West Chenango Telephone Company has been incorporated, capital $500. Directors: J. M. Brooks, of Castle Creek; Benjamin B. Worden, of West Chenango, and W. L. Treadwell, of Glen Castle.

ANDOVER, OHIO.—The Westford Independent Telephone Company has begun work on its line to Jamestown.

GERMANTOWN, OHIO.—The Germantown Independent Telephone Company is building a line to a point north of the town to connect with the Farmersville Telephone Company.

NORWALK, OHIO.—The local telephone company is enlarging its exchange at Berlin Heights with the view of adding new subscribers. A new line is being built between Milan and the Heights.

CINCINNATI, OHIO.—The Newport City Council has passed an ordinance to advertise for bids on a telephone franchise for a new company to compete with the Citizens' Telephone Company, which now has a monopoly.

PERRYVILLE, OHIO.—The Maumee Valley Telephone Company is very busy just now extending its service to the citizens of Stony Ridge and Lima City, as well as to the residents of the country surrounding these towns.

OXFORD, OHIO.—The Oxford Telephone Company has just contracted with Miami University to put in 22 telephones in the buildings with a private exchange, and two trunk lines connecting the system with the Oxford exchange.

COLUMBUS, OHIO.—The Leeds Telephone Company will extend its line from West Columbus to the F. & M. U. Bank Building in Columbus, where it is to connect the several independent lines entering Columbus in a general office.

ANDOVER, OHIO.—Work has been begun by the Westford Independent Telephone Company in order to enter Jamestown. This will put that place in speaking distance with Andover, Espyville, Espyville Station, Westford, Hartstown and Adamsville.

WAPAKONETA, OHIO.—At the recent meeting of the stockholders and bondholders, representing several hundred thousand dollars' worth of bonds of the Commercial Telephone Company, of Houston, Tex., it was announced that application has been made to the court for the appointment of a receiver.

LEWISTON, IDA.—The Nez Perce Telephone Company is building a line from Culdesac to this place.

EMETT, IDA.—The Rocky Mountain Bell Telephone Company is constructing a line between this place and Thunder Mountain, and will probably extend it to Roosevelt.

BOISE, IDA.—The Twin Falls Telephone Company, with headquarters at Blue Lakes, has been organized to build a telephone line from Twin Falls to Blue Lakes, capital $15,000. Incorporators: I. B. Perrine, R. M. McCollum, H. H. Jacobs and S. H. Hays.

JACKSONVILLE, ILL.—The Illinois Telephone Company has increased its capital stock from $100,000 to $500,000.

SOUTH McALESTER, ILL.—A franchise has been granted to the Independent Telephone Company, Shooler Bros. owners.

DEFIANCE, ILL.—The Putnam County Telephone Company, a home institution, has changed its service and is now connected with the Bell system.

HANNIBAL, ILL.—Incorporation papers of the Adams-Pike Counties & Hannibal Telephone Company have been filed with the county recorder. The incorporators are William H. Breckenridge, John W. Buttz, Samuel S. Inman and Charles H. Rankin. The capital stock of the new company is $7000.

CHICAGO, ILL.—The Chicago Telephone Company has offered to put telephones in the schools at a rate of $75 for each school, with slot telephones in the schools and free service from the board rooms to school connections. The total cost would be $18,000 a year.

HEBRON, ILL.—Forty farmers in the town of Hebron have organized a new telephone company under the name of the Farmers' New Era Telephone Company. They have purchased from the Citizens' Telephone Company, as their exclusive field of operation, all of Alden and Hebron townships and the north half of Greenwood township and the lines of the Citizens' Company in that territory. Hebron will be the central station. George Hunt is president of the company.

CEDAR FALLS, IA.—The Iowa Telephone Company will rebuild its entire system here.

MANNING, IA.—The Manning Telephone Company has been incorporated with $21,000 capital. President, W. B. Swaney; manager, P. Zerwas.

WATERLOO, IA.—A site has been purchased for the building to be erected here for the Iowa Telephone Company. The company will probably expend some $125,000 on the building and improvements.

CYPRESS, IND.—The Cypress Telephone Company has been incorporated by J. F. Edmond and others. Capital $2500.

NEWPORT, KY.—The Newport Council has passed an ordinance advertising the sale of a telephone franchise. The measure must pass the Board of Aldermen and be signed by the Mayor before it becomes effective. It is aimed to let in independent telephone intersts, and is being bittrly fought by the Citizens' Telephone Company, the Bell Company in Kentucky.

CHINA, ME.—The China Telephone Company has been organized here with $10,000 capital.

BALTIMORE, MD.—Hochild, Kohn & Company are installing a private telephone system here.

WESTFIELD, MASS.—The Westfield Telephone exchange has instituted a reduction in rates for subscribers for one and two-party line service. Business rates $42 instead of $48 per year, residences $36 instead of $42.

ST. PAUL, MINN.—The Henderson Telephone Company has been formed with $10,000 capital stock.

RENVILLE, MINN.—The farmers north and northwest of this town have organized a company to put in a rural telephone line from Prinsberg to Renville.

ROLLA, MO.—The Rolla Telephone Company has been incorporated with $20,000 capital by J. B. Harrison and others.

OSWEGO, N. Y.—The Empire State Telephone Company has a franchise to extend its lines.

HOLLEY, N. Y.—The Interocean Telephone Company has been granted a franchise to build a telephone exchange in this village.

PREBLE COUNTY, OHIO.—The Lewisburg Telephone Company has increased its capital from $10,000 to $20,000.

COLUMBUS, OHIO.—The Columbus Citizens' Telephone Company has increased its capital from $750,000 to $1,250,000.

ANTIOCH, OHIO.—Local telephone connections have been made with Antioch. Dr. W. V. A. Polen has charge of central at that place.

OTTAWA, OHIO.—The Farmers' Mutual Telephone Company has succeeded in securing many subscribers in the northern part of the county, in business houses and homes. Not only in Putnam County, but in many nearby towns, good service is guaranteed at the rate of 30 cents a month. The subscriber pays for his own instrument, when it is placed in his home or business house.

EAST LIVERPOOL, OHIO.—The Columbiana County Telephone Company will install a complete new inside equipment in their East Liverpool exchange at a cost of about $10,000. The installation of the new system in Liverpool will be followed by a like process in the Wellsville exchange, after which the exchanges over the entire county will be torn out and the latest design inside apparatus installed, beside a thorough overhauling and modernizing of parts of the outside equipment.

CINCINNATI, OHIO.—A syndicate of bankers representing several cities has completed arrangements to loan $450,000 to the United States Telephone Company of Ohio. It has been agreed that the money will be provided as rapidly as the company needs it for extensions and improvements. It is understood that Cincinnati is one of the objective points of the big independent company. No definite time is stated for the repayment of the loan, but guarantees are given that it will be carried for three years. It is estimated by insiders that the expenditure of $400,000 new money on improvements and betterments at this time will add $200,000 a year to the gross earnings.

CLEVELAND, OHIO.—The United States Telephone Company reports an increase in gross earnings of about 9 per cent. for June, over the same month last year. The statements compare as follows:

	June	
	1904.	1903.
Gross earnings	$34,471.07	$31,693.60
Expenses and taxes	22,081.07	20,793.12
Net earnings	$12,390.00	$10,900.48
Deductions	8,277.92	8,132.50
Surplus for period	$4,112.08	$2,767.98

TOLEDO, OHIO.—A meeting of the directors of the Peninsular Telephone Company, of Tampa, Fla., was held last week at the office of the I. H. Detwiler Company. A proposition for enlarging the system was closed and another proposition for the extension of toll lines and connecting with other systems was taken up. Among the out-of-town directors attending the meeting were J. H. Goeke, S. A. Hoskins and W. G. Brorein, of Wapakoneta, Ohio. These gentlemen are also interested in several other telephone companies in Florida and Texas. Mr. Goeke was recently appointed receiver of the Commercial Telephone Company, of Texas, and in speaking of the difficulty of the company, said it was not due to lack of earning capacity nor to real mismanagement, but to over-capitalization, or rather over-bonding, and that the company could easily be operated to make money.

ENID, OKLA.—The Enid Rural Telephone Company has been formed with $30,000 capital by R. A. Williams, W. T. Milan and others.

FREDERICK, OKLA.—The Frederick Telephone Company has been formed by A. X. Campbell, J. M. Bellamy and W. C. Shaw. Capital, $3500.

BAKER CITY, ORE.—A telephone line is to be constructed from Pine to Homestead, a distance of about 28 miles.

LA GRANDE, ORE.—The La Grande Telephone Company will install a new switchboard and make other improvements at a cost of $12,000.

ALLENTOWN, PA.—The Lehigh Telephone Company is building a new line, 8 miles long.

PITTSBURG, PA.—The Pittsburg & Allegheny Telephone Company is making arrangements to extend its system to Wheeling.

BROOKVILLE, PA.—The Redbank Telephone Company, with a capital of $10,000, has been chartered. The main office of the company will be located at Brookville.

WASHINGTON, PA.—The State Department at Harrisburg has issued a charter to the Farmers' Mutual Telephone Company, of Washington County, which is capitalized at $30,000.

READING, PA.—The Consolidated Telephone Company has announced that it will expend $100,000 in telephone improvements in Berks and Lebanon counties. A line will be built from Reading to Lebanon. It will take in all of the towns west of Reading as far as Lebanon. The other lines will be built from Reading to Lancaster County and Birdsboro, respectively.

DOYLESTOWN, PA.—The Standard Telephone & Telegraph Company has been placed in the hands of receivers. I. D. Gindhart, auditor of the Keystone Telephone Company, and T. O. Atkinson, treasurer of the Bucks County Trust Company, have been named as receivers. The Standard is a Pennsylvania corporation, capitalized at $100,000. It was incorporated in 1891, and G. W. S. Brubaker, of Lancaster, is president of the company. It operates eight telephone exchanges, with pole lines between Doylestown, Newtown, Hatboro, Yardley, Bristol, Quakertown, Perkasie, Langthorne, Morrisville and points in New Jersey, including Burlington and Riverside. The system is valued at $150,000.

YANKTON, S. D.—The Independent Telephone Company is preparing to build a line from here to Mitchell.

CANTON, S. D.—A telephone exchange is being installed at Marion Junction for the Dakota Central Company.

PINE BLUFF, TENN.—The Southwestern Telegraph & Telephone Company will spend about $75,000 in improving its service at Pine Bluff, including the placing of its wires underground.

HUNTINGDON, TENN.—A new telephone company, known as the Consolidated Telephone & Telegraph Company, has just been granted a charter. The incorporators are J. K. Barlow and J. F. Barlow, of Savannah; T. S. Hughes, of Clifton; F. E. Schwabb, of Nashville; H. B. Stubbefield, of Densons, and W. N. Sloan, of Linden. The capital stock is $50,000. The company will operate lines in Perry, Wayne, Hardin and adjoining counties.

CANADIAN, TEX.—The Stockmen's Telephone Company has increased its capital from $2500 to $5000.

CHEAPSIDE, TEX.—The Cuero & Cheapside Telephone Company, with principal office at Cheapside, Gonzales County, has been formed, capital stock $500. to build telephone lines. Incorporators: J. E. Lord, J. F. Elder and C. F. Carson.

AUSTIN, TEX.—Application has been made in the district court here for a receiver for the Commercial Telephone Company, which operates independent long-distance telephone systems in southeastern and central Texas. The Territorial Loan & Trust Company is trustee for the bondholder, and the grounds for its application for the receivership were that the debt amounting to $427,000 against the telephone company has matured through its failure to pay the interest.

OGDEN CITY, UTAH.—A gang of expert splicers have begun work laying the underground cable for the Utah Independent Telephone Company.

BEAVER DAM, WIS.—The Leeds Telephone Company proposes extending its line.

AMBERG, WIS.—The Amberg Telephone & Telegraph Company, capital $3000, has been incorporated by A. W. Larsen, J. A. White and others.

CAMBRIA, WIS.—The Cambria Co-operative Telephone Company has been formed, capital stock $1000. Incorporators: H. W. Thomas, Chris Hecker, E. D. Ford and sixteen others.

MILWAUKEE, WIS.—A new line to Madison, costing $30,000, is being planned by the Postal Telegraph Company. At present the business between Milwaukee and the state capital is carried on by way of Chicago, and there is no direct connection.

LONDON, ONT.—The city council has granted the Bell Telephone Company a franchise here.

ELECTRIC LIGHT AND POWER.

HARTFORD, CONN.—Work has begun upon the new plant of the Hartford Electric Light Company at Dutch Point and by the first of December the big turbines will be revolving on the site of the House of Hope, the Dutch fort that was started in 1623, ten years before any Englishman made his appearance in those parts.

WASHINGTON, D. C.—The Nevada Electric Power & Transmission Company has filed a certificate of incorporation, capital $5,000,000. Incorporators: Dr. Francis E. Williams, John Fletcher Burris, Charles P. Williams, Harvey T.Winfield, Harry A. L. Barker, James W. Slye and Jesse H. Wilson, Jr.

GAINESVILLE, GA.—W. A. Carlisle, chief engineer of the Georgia Electric Company, has completed the plant and will now furnish power to the city.

FORT WAYNE, IND.—A suit which has aroused the indignation of Mayor Berghoff has been brought by the Rev. Samuel Waganhals, of the Trinity Lutheran Church, against the city of Fort Wayne, together with the Fort Wayne Electric Light Company and the Jenney Electric Light & Power Company, to declare illegal the franchise granted by the city to the Fort Wayne Electric Light & Power Company. The plaintiff claims that the city had no right to grant the franchise, as it already had accumulated $60,000 with which to establish a municipal light plant, and it alleges that in order to secure the passage of the ordinance the signatures of Mayor Berghoff and two members of the Board of Public Works were secured by fraud. Mayor Berghoff protests vigorously against this allegation.

GLOUCESTER, MASS.—A Curtiss steam turbine of 500-kw will be put in by the Gloucester Electric Company.

FALL RIVER, MASS.—For financial reasons the city has, for the present, abandoned the idea of purchasing the Fall River Electric Light Company's plant.

WESTFIELD, MASS.—The machinery for the town's electric plant has been made at the Stanley works in Pittsfield. It is expected to have the plant in full operation by the end of the month.

ROSLYN, N. Y.—The Nassau Light & Power Company is now building a new plant at Glenwood, Long Island.

CORNING, N. Y.—The Corning Gas & Electric Company intends putting in a new 250-kw alternating-current generator.

NEWTON, N. J.—The Newton Gas & Electric Company is entirely remodelling its electric station and putting in a complete three-phase system operated by gas engines from a producer gas plant.

ALBANY, N. Y.—The Central Power Mfg. Company, of Albany, has been incorporated to furnish electricity for light, heat and power, capital $10,000. Directors: Chas. R. Huntley and D. T. Nash, of Buffalo. The company will operate in the counties of Schenectady, Saratoga, Albany and Rensselaer, the cities of Schenectady, Cohoes, Troy and Albany, and the towns of Granville, Rotterdam and Niskayuna, Schenectady County; Clifton Park, Half Moon and Waterford, Saratoga County; Watervliet and West Troy, Albany County, and Lansingburg, Troy and North Greenbush, Rensselaer County.

BETHEL, OHIO.—The new village lighting plant has been placed in operation.

GARRETTSVILLE, OHIO.—The Forde Lighting Company has been formed, capital $25,000, by A. W. Green, W. B. Martin, O. G. Martin, Mrs. Minnie Martin and E. E. Martin.

CANTON, OHIO.—The Courtland Hotel Company which is building a hotel in Canton is endeavoring to secure a franchise to enable it to supply electric light and steam heat in the residential and business sections of the city.

HARRISON, OHIO.—The Harrison Water & Light Company has been incorporated with $25,000 capital stock by A. Reich and others. The company will establish water and lighting plants at Harrison, Ohio, and West Harrison, Ind.

XENIA, OHIO.—The Xenia Heat, Light & Power Company is preparing to put in an electric heating and lighting plant. The company is incorporated by Judge Kunkle, Judge Hagan and Frank Torrence, of Springfield; Milo R. Snodgrass and H. N. Schlesinger, of this city, the latter two being president and secretary of the company.

KINGSTON, ONT.—The city will take over the Kingston Light, Heat & Power Company's plants, gas and electricity, on August 1, and they will be hereafter municipal utilities. The city has notified the manufacturers that flat rates will be abolished for the present. Later new rates will be made with manufacturers and special concerns. Mr. John M. Campbell, a local electrical expert, has been engaged at $2000 per year to make plans and specifications for improvements and to oversee changes.

AVOCA, PA.—The Standard Electric Light, Heat & Power Company is enlarging its electric and steam equipment and extending its lines.

YORK HAVEN, PA.—The hydro-electric plant of the York Haven Power Company has been given its first test and proved most satisfactory. It is the aim of the officials to send power to York not later than the end of August.

LEONARD, TEX.—The Electric Light Company of Leonard has filed an amendment to its charter increasing its capital stock from $15,000 to $20,000.

OSHKOSH, WIS.—W. H. Whitney, of Boston, has purchased the property of the Oshkosh Electric Light & Power Company, which has been for the past eighteen months in the hands of a receiver. The price paid was $215,000.

THE ELECTRIC RAILWAY.

KINGMAN, ARIZ.—The survey has been completed for an electric railway that is to be constructed from Yucca, Ariz., to the mining camp of Cedar. The proposed road is to handle both freight and passengers.

ITHACA, N. Y.—It is understood that the Lehigh Valley Railroad has recently declined the offer of the Ithaca Street Railway system. This was in connection with the plans looking to the electrification of the line from Ithaca to Auburn and Ithaca to Camden. Lehigh Valley is situated similarly to the New York Central, in the central and western part of the State of New York. Trolley construction there has made serious inroads on its passenger traffic.

LOVELAND, COL.—An ordinance has passed granting a franchise to the Northern Colorado Electric Railway Company. The proposed road is to run through Eaton, Windsor, Fort Collins, Loveland, Berthoud, Longmont and Boulder to Denver.

STONINGTON, CONN.—The shareholders of the Groton & Stonington Street Railway have voted to issue not more than $375,000 of first mortgage 5 per cent. gold bonds of $1000 each, to provide for the construction and equipment of the line, work on which is now in progress.

DANBURY, CONN.—The Industrial Construction Company, of Philadelphia, has taken the contract to complete the street railway which the Danbury & Harlem Traction Company proposes to operate between this city and Golden's Bridge, N. Y., a distance of about 17 miles. The traction company has recently obtained a clear title to several pieces of needed property. Previous failure to secure such a title has been one of the reasons for holding up the work. Three years ago the road was partially built. Much grading was done and a part of the rails were laid. A large power house was nearly completed. The work was then suspended and has not since been resumed. It is confidently believed that the complications and obstructions have now been overcome and that the road will be completed.

PENSACOLA, FLA.—The Pensacola Suburban Electric Company is the name of a new company formed by A. C. Berry, J. E. Wolf and others.

FORT SMITH, ARK.—The City Council has granted the Sebastian County Electric Railway a charter. The company will build about 35 miles of track.

PEKIN, ILL.—The Springfield, Lincoln, Bloomington, Pekin & Peoria Electric Railway Company has increased its capital stock from $50,000 to $300,000.

CHICAGO, ILL.—The name of the Chicago & Indiana Air Line Railway Company was changed to the Chicago, Lake Shore & South Bend Railway Company, at a special meeting of the stockholders held Aug. 1. The line is partly completed between Indiana Harbor and South Bend. F. B. Wagner, of Cleveland, was elected president and J. B. Hanna, vice-president. The stock was increased to $3,000,000.

SPRINGFIELD, ILL.—The Illinois Valley Railroad has been incorporated, with a capital stock of $100,000. The principal office is at LaSalle. The line is to be constructed from Joliet in a southwesterly direction to Morris, Grundy County; thence in a westerly direction to Marseilles, Ottawa, LaSalle and Peru, LaSalle County; thence westerly to Spring Valley, Ladd and Princeton, in Bureau County. The incorporators and first board of directors are Frank W. Berard, of LaSalle, and H. Eugene Chubbuck, Vincent J. Duncan and Albert F. Schock and Charles E. Hook, of Ottawa.

SOUTH BEND, IND.—Announcement has been made in this city and in Elkhart that within two weeks the St. Joseph Valley Traction Company will issue ten and twenty-year 6 per cent. gold bonds to pay for the cost of constructing and equipping the Lagrange, Elkhart & South Bend Interurban Road. The aggregate amount of the bonds will be about $1,000,000. The road will be 50 miles long, and the cost of equipping and constructing it is estimated at from $20,000 to $25,000 a mile. Stafford Maxon, secretary of the company, states that just enough bonds will be issued to cover the cost. He said that H. E. Bucklen will give Elkhart and South Bend citizens a chance to buy the bonds, and those not sold within a reasonable length of time he will take up himself.

SALISBURY, MD.—The Wicomico Electric Railway Company, incorporated by the last Legislature and granted a franchise covering Wicomico County for an electric railway system, has organized as follows: Thomas Perry, president; C. R. Disharoon, vice-president; H. L. Brewington, treasurer, and W. S. Gordy, Jr., secretary. The plan is to build an electric railway in Salisbury and an extension to Bivalve.

WESTPORT POINT, MASS.—Offices have been opened here by the Horseneck Street Railway Company, which plans to build an electric railway through Dartmouth and Westport, between the cities of Fall River and New Bedford, along the shore.

NUEVO LEON, MEX.—The Monterey Electric Street Railway, Light & Power Company, of Camden, N. J., has been incorporated with a capital stock of $225,000. Incorporators: William T. Wheeler, E. F. Walker and T. H. Beckett, all of Philadelphia. The company is to acquire in the State of Nuevo Leon, Mexico, certain franchises and to construct and operate street railways and light and power plants.

MANKATO, MINN.—The Mankato Electric Light Company has been granted a franchise for a street railway.

WINONA, MINN.—The Winona Railway & Light Company proposes to issue $40,000 in bonds for improvements and refunding purposes.

JACKSON, MISS.—The organization has been completed of the Fort Adams, Woodville & Centerville Electric Railroad Company, to build an electric railway from Fort Adams to Centerville, via Woodville. Dr. W. H. Woods, of Jackson, is interested.

COLUMBUS, MISS.—The promoters of the proposed electric railway here have deposited $1000 as a guarantee of good faith. Actual work must be begun by Dec. 25, and 3 miles of lines must be in operation one year from that date.

MINNEAPOLIS, MINN.—One of the most important improvements relative to rapid transit in the Twin Cities now under way, is the new street car terminal at the Minnesota State Fair Grounds. The Twin City Rapid Transit Company formerly operated its cars from Como Avenue outside the grounds, but has been permitted to lay 20 parallel tracks through the center of the grounds. It is estimated that this will obviate the difficulty of egress and do away with the crush outside the grounds and that the business of state fair week will in consequence be handled at less relative cost than ever before.

RENO, NEV.—Articles of incorporation of the Nevada Transit Company have been filed with the Secretary of State, and the work of grading on the prospective route between this city and Sparks has already been commenced. The capitalization of the company is $250,000.

MOUNT HOLLY, N. J.—J. Stokes, J. Lippincott, L. Roberts, J. L. Trimble, A. C. Heulings and W. D. Lippincott, of Moorestown, have formed the Moorestown Rapid Transit Company, for improved trolley and train service between that place and Camden.

EGG HARBOR CITY, N. J.—John A. Bozarth, representing a large syndicate, has been granted the right of way on Philadelphia and Antwerp Avenues for electric railway lines, which are to traverse 12 miles of these streets. The new line is to connect with that at Absecon, and will extend from here to Tuckerton and all intermediate places. The city also sold to the same person 2200 lots lying on the eastern section of the town and fronting on the Mullica River. It is proposed to fill in all the low land and improve it.

BUFFALO, N. Y.—The Buffalo & Southeastern Railway Company has been incorporated with a capital of $300,000 to operate a street railway from East Aurora to Buffalo, passing through Spring Brook and Ebenezer, a distance of 12 miles. The directors of the company are Fay H. Ball, E. Eugene Henshaw, Densmore Pratt and James Cadzaw, of East Aurora; T. S. Miller, B. J. Cole and James B. Kennedy, of Willink; Odell R. Blair, of Buffalo, and James L. Balser, of Ithaca.

PORTLAND, ORE.—The stockholders of the City & Suburban Railway Company will vote on Aug. 15 on a proposition to sell the capital stock to a new corporation that shall also control the Portland Railway, thereby consolidating the Portland street railways under one management.

SALEM, ORE.—Manager L. B. French, of the Portland & Southern Railway Company, which proposes to build an electric railway from Canemah to Salem, is in Salem making arrangements for a permanent survey of the route for his road. The survey will begin at once and it is his expectation that a considerable portion of the construction work will be completed this year.

EUGENE, ORE.—The Willamette Valley Electric Railway Company has been incorporated for $1,000,000 by Congressman J. F. Wilson, of Arizona; M. S. Taft, of Binghamton, N. Y.; W. J. Wilsey, of Arizona, and others. Eugene will be the center of operations. The County Court is asked to give a franchise from Eugene to Blue River, Eugene to Florence, Eugene to Cottage Grove, Eugene to Junction and on north to the county line. Benton County will be asked to give a franchise to Corvallis. The idea is to connect with the line from Salem to Portland.

DARBY, PA.—Representatives of the Darby & Yeadon Electric Railway Company are securing private right of way through those two towns.

DAUPHIN, PA.—Engineers have made another survey for an extension of the line of the Central Pennsylvania Traction Company from Fort Hunter to this place.

COLUMBIA, PA.—Councils have passed an ordinance amending the franchise ordinance of the Columbia & Ironville Street Railway Company, allowing the company to reconstruct its line.

NEW CASTLE, PA.—The City Council has ordered the local street railway companies to equip all cars with safety fenders, and prescribes a fine for failure to have cars thus equipped after a certain date.

LEBANON, PA.—Daniel Kline, owner of Valley Glen Park, near Palmyra, states that he will build a trolley line from Palmyra to the Park himself if the parties now negotiating for the right of way give up the project.

SCRANTON, PA.—It is said that contracts will be let within a few days for the construction of an electric railway line from Factoryville to Tunkhannock, which will be known as the Scranton, Factoryville & Tunkhannock Railroad.

RIDGEWAY, PA.—Surveys for the Elk Street Railway Company's line connecting St. Mary's, Ridegway & Johnsonburg are going forward. W. S. Ravenscroft, of Ridgeway, is president of the company, which is capitalized at $102,000.

TITUSVILLE, PA.—Nearly a mile of track has been laid on the extension of the Titusville Traction Company from Mystic Park to Tyronville. It is not improbable that the road will be further extended next summer, and may be continued to Canadohta Lake and Meadville.

LEECHBURG, PA.—Work on the new electric railway between Leechburg and Apollo is to start at once. Offices have been opened at Leechburg, with Blake Mapledoram as general manager. Smethurst, Allen & Baker, of Philadelphia, have the contract for construction.

YORK, PA.—The York County Traction Company's new line to York Haven is now in operation. This leaves a gap of but 7 miles between York and Harrisburg, and it is expected that this will be closed by the building of a line from York Haven to Newberrytown next year.

IRWIN, PA.—The Council of Manor has granted the Pittsburg & Westmoreland Railway Company a franchise to build its line in the borough. This line will be part of the Irwin-McKeesport project. From here it will extend to Manor via Shafton and Westmoreland City. Nearly all the right of way has been secured.

WAYNESBORO, PA.—Pittsburg and Cumberland capitalists are endeavoring to purchase the franchise of the Hagerstown, Waynesboro & Pen-Mar Electric Railway Company and the line between Hagerstown and Waynesboro via Leitersburg and Pen-Mar. At the recent session of the Maryland Legislature the company secured a two-year extension of its original franchise, but has done nothing as yet toward building the line. The distance is about 11 miles.

CLEBURNE, TEX.—L. W. Dunn and associates are promoting a street railway system and the installation of an electric light plant at Cleburne.

BONHAM, TEX.—The Bonham & McKinney Electric Railway Right of Way Company of McKinney, capital stock $5000, has been incorporated. The incorporators are F. W. Potter, A. Rasmus, E. W. Townes and F. W. Johnston.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company has begun the construction of a transformer plant near Jordon.

SISTERVILLE, W. VA.—J. F. Partridge, of Parkersburg, assistant superintendent of the Parkersburg & Ohio Valley Electric Railway Company, is here for the purpose of establishing an office preliminary to commencing the construction of the road within the corporate limits of Sisterville. The franchise granted to the company by Council expired July 1 last and was extended sixty days upon application. It is now a settled fact that the road will be built, and there is much rejoicing in the matter in this locality. The first section of the road to be built is from this city to Friendly, a distance of 5 miles, and from there the line will be continued without delay to Williamstown, where it will connect with the Parkersburg system. In this city a connection will be made at the intersection of Diamond and Wells Streets with the Wetzel-Tyler Electric Railway. It is the general opinion that there will ultimately be a merger of the roads, and that the joint interests will extend the construction to Moundsville and finally to Pittsburg. C. L. Williams, the general superintendent of the Parkersburg Company, held a similar position at one time with the old Ohio River Railroad, while Mr. Partridge was identified with it as traveling auditor. Both are therefore practical railroad men.

NEW INDUSTRIAL COMPANIES.

ANDERSON ELECTRIC COMPANY has been formed in the District of Columbia with a capital stock of $25,000 by D. M. Anderson, O. C. Salein, Jr., and W. A. Pate.

PORTLAND, ME.—The Imperial Electric Motor Company has been formed. Capital, $1,000,000. Promoters, H. E. Mason, A. S. Conant, James L. Etter, Abner Goddard, Portland.

THE ELECTRIC DREDGE COMPANY, of New York City, has been formed under the laws of New York, with a capital stock of $100,000 by Louis E. Spencer, Ezra A. Tuttle and Charles N. Flint, New York.

ROCHESTER, N. Y.—The incorporation papers of the Almstead Electric Company have been filed. The company is capitalized at $30,000, with the following as directors: Morris J. Almstead, John A. Almstead, Mary E. Almstead, Edward F. Pillow and George H. Harris.

THE UNITED STATES RAILWAY SIGNAL & TELEPHONE COMPANY, of St. Paul, Minn., has been incorporated with a capital stock of $1,000,000. This company will engage in the manufacture of what is known as the Johnson-Ballard electric signal. James A. Ballard, Horatio A. Johnson and Angelo H. Sprague, of St. Paul, are the incorporators.

LEGAL.

WHAT IS A PARTY LINE?—The Cuyahoga Telephone Company has brought suit against the Dime Savings & Banking Company to compel it to issue bonds in the sum of $167,000, which it has been holding as trustee for the telephone company. The dispute centers around the question whether or not lines using the same circuit from the same trunk, but otherwise separate, are to be considered single lines. The trust company had a contract to issue bonds for new lines completed by the telephone company, but declines to issue bonds on a certain number of new lines which are declared to be party lines. The court will be asked to define the status of a party line.

RICHMOND, VA., TROLLEY INTERESTS.—The Goulds have for a second time beaten George E. Fisher in the Virginia courts, and on August 8 they secured a writ of error and petition for appeal in the matter of the appointment by Judge Mullen, of Petersburg, of George E. Cameron, Jr., as Fisher's receiver for the Virginia Passenger & Power Company properties. The appeal was granted by Judge R. H. Cardwell, of the State Supreme Court, who signed the papers at 7:30 o'clock A. M., after another sensational race between lawyers. The records were copied by expert stenographers, who worked all day Sunday, August 7, in order to get them ready. Meanwhile, Fisher's lawyers were preparing to take an appeal from United States Judge Waddell's decision appointing Messrs. Wickham and Northrop. The latter will hold on as receivers until the appeal case is tried, perhaps next spring.

TELEPHONE POLES ON STREETS.—The New York Supreme Court Appellate Division has sustained the appeal of the New Union Telephone Company vs. Marsh et al. on its petition to condemn land for telephone pole construction. The points made are: (1) Laws 1890, p. 1152, c. 566, § 102, gives to a telephone company the right to erect and maintain the necessary fixtures for its wires over any of the public roads and streets within the State. Laws 1897, p. 394, c. 414, § 89, subd. 9, authorizes the trustees of villages to regulate the erection of the telephone poles and the stringing of wires over the streets. The trustees of a village adopted a resolution authorizing one

to erect poles and fixtures and to string wires for a telephone system under the direction of the trustees, and declaring that, if the work was not completed within a specified time, the consent should cease. Held, that the franchise to use the streets come from the State, and the power to regulate the erection of the poles and wires in the streets of a village rests with the trustees, making it immaterial whether the consent granted by the village had expired. (2) Code Civ. Proc. § 3361, requires that the petition in condemnation proceedings shall be served on all the owners of the property. Section 3358 defines the word "owner" to include all persons having any estate, interest, or easement in the property to be taken. Held, that in proceedings to condemn property in a public street, the fee of which is in a private individual, for the erection and maintenance of a telephone system, the municipality is not a necessary party. (3) Transportation Corporation Law, Laws 1890, p. 1152, c. 566, § 102, authorizing a telephone company to erect and maintain its lines over the streets and highways, and declaring that, if it cannot agree with the owner on the compensation to be paid therefor, the compensation shall be ascertained in condemnation proceedings, empowers a telephone company to take proceedings to condemn the right to place its poles and lines in a street in front of an owner's property. (4) A telephone company seeking to condemn the right to erect poles and lines in a street in front of an owner's property should only be permitted to acquire an easement for its poles and wires in the street. (5) A petition by a telephone company in proceedings to condemn land in a street for its poles and wires should not be dismissed because it sought to acquire the fee in the land, instead of merely an easement for its poles and wires. (6) A petition by a telephone company in proceedings to condemn land in a street for its poles and wires is not defective for failing to allege that the municipality has consented to the erection of the poles and wires at the places sought for the location of the poles and wires. (7) A judgment that a telephone company had no right to maintain its poles and lines in a street without the consent of the abutting owner, and without acquiring the right to do so in a lawful way, is not a bar to a proceeding by the company to condemn the right to erect the poles and lines in the street.

PERSONAL.

MR. GEORGE G. KING has been appointed general manager of the Youngstown, Ohio, Telephone Company. He has been superintendent of the construction for the company for several years.

MR. SAMUEL T. HOWE has accepted the position of manager at Topeka, Kan., for the Bell Telephone Company, succeeding R. B. Gemmell, who will be assigned to other duties with the company.

PROF. D. C. JACKSON, of the University of Wisconsin, is, we are glad to note, recovering from his recent accident, and his broken wrist is just again getting into use. His wife was not injured in the runaway, but his aunt, Mrs. E. M. Cravath, who was with them, had her arm broken.

MR. E. L. NASH.—The General Incandescent Arc Light Company has appointed Mr. Ed. L. Nash district manager for its branch office at 1208-1209 North American Building, Philadelphia, Pa. Mr. Nash has been connected with the Jandus Electric Company in the capacity of Eastern sales manager for the past nine years.

MR. JOHN B. STETSON has presented to Bucknell University two 100-hp boilers for the electric lighting plant which will light the thirteen university buildings and the campus. Mr. Stetson is a member of the board of trustees of the university, and has contributed from time to time toward the endowment and building funds.

MR. H. C. RICE.—Mr. H. C. Rice, who for several years has been connected with the Arc Lamp Department of the General Electric Company at Schenectady, has resigned his position to accept the management of the Arc Lamp Sales Department of the General Incandescent Arc Light Company, New York City. Mr. Rice is well known in amateur theatrical circles and is a member of the Schenectady Jest and Song Club. He leaves a large circle of friends who wish him all success in his new position.

MR. JAMES W. LYONS announces his resignation as manager of the power department of the Allis-Chalmers Company. His resignation took effect on Aug. 13. Mr. Lyons has taken this step in order to accept the appointment as consulting engineer to the Elgin Watch Company, of Elgin, Ill., which will erect new and extensive works under his supervision. He will also engage in other consulting work, and his headquarters will be at Chicago. Mr. Lyons takes with him the good wishes of all his former associates in the Allis-Chalmers Company.

MR. F. A. LA ROCHE, the electrical engineer and automobilist who left this city on July 25 to make a non-stop run to St. Louis and return, brought his long ride to an end in front of the clubhouse of the Automobile Club of America, Fifty-eighth Street and Fifth Avenue, which was also the starting point of the trip, at 11:42 A. M. on August 9. The engine of his Darracq gasolene car had revolved continuously for fifteen days and two hours, in which time he had covered 3540 miles, beating by 1437 miles the previous non-stop record of 2013 miles, made by D. M. Wiegel, in England recently.

MR. ROSCOE CORNELL has been appointed manager of the branch office which the Allis-Chalmers Company has just opened in El Paso, Texas. He goes to the Allis Chalmers Company from the Mine & Smelter Supply Company of Denver. He is a graduate of the Michigan College of Mines, and is well known as a mining and mechanical engineer. He has held a number of prominent positions as a mining engineer, and as a smelter and mine superintendent. His acquaintance is extensive, and he is thoroughly qualified to fill the important position to which he has just been appointed.

MESSRS. H. M. BYLLESBY & COMPANY, of Chicago, Ill., have been appointed engineers for the Fort Smith Light & Traction Company, of Fort Smith, Ark. Extensive improvements and extensions to the electric light, gas and street railway will shortly be undertaken. They have also recently contracted to construct and erect an extensive high pressure gas system for the Muskogee Electric & Gas Company, at Muskogee, I. T. This firm has, in addition, been appointed engineer for the Oklahoma Gas & Electric Company, Oklahoma City, Okla. Extensive improvements and extensions to the gas and electric properties will shortly be undertaken.

HON. WILLIAM I. BUCHANAN, deputy chairman and a director of the British Westinghouse Electric & Manufacturing Company, Limited, and also a director of the other Westinghouse interests in Europe, arrived in this country on August 10, and will remain here several weeks before returning to London. He reports business in England and on the Continent as being quiet. The French Westinghouse Company's Board has been lately reorganized, four new directors having been elected. The new members are among the most prominent and well-known business men of France. The new chairman of the French Company's executive committee is one of them, the Marquis de Frondeville, one of the most widely known among French banking officers.

Trade Notes.

NEW YORK TELEPHONE COMPANY, 15 Dey Street, New York, calls attention to its telephones by means of a convenient miniature calendar for the next twelve months.

THE GERMANIA LAMP COMPANY, of Harrison, N. J., announces the appointment of the Goudey-McLean Company, 120 Liberty Street, New York, as its sales agent for Greater New York.

THE LOCKE INSULATOR COMPANY, Victor, N. Y., in order to make still closer and more systematic study of high voltage insulating problems, has installed recently a 300,000-volt transformer of 200-kw capacity, whose primary will be supplied with current from a 200-kw motor generator set connected with a neighboring transmission line.

WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has issued a circular, No. 19,046, describing its new "ceiling fan controller." It is designed to have such a handsome appearance that it can be mounted appropriately in finely furnished rooms. The company states that it is receiving large orders for this type of controller.

NEWTON MACHINE TOOL WORKS, Philadelphia, in catalogue No. 39, describe and illustrate cold saw cutting-off machines which have recently been redesigned as a result of extensive experience. A number of heavy duty machines, as illustrated, are electric motor-driven, the driving motors being connected directly through gears, belts or chains.

NERNST LAMP COMPANY, Pittsburg, has reprinted in pamphlet form an article describing the street lighting in Berwyn, Ill., where Nernst lamps are used exclusively. The design and installation of the equipment, which has proved economical in operation and given satisfaction to the citizens, were completed under the direction of Charles W. Carmen, consulting engineer, of Chicago.

THE CENTRAL ELECTRIC COMPANY, Chicago, as general western agent for the Pittsburg Transformer Company, announces that it is prepared to furnish "boosters" of Pittsburg make. As the demand for these is continually growing, the company naturally anticipates a very good business and states that it can make it worth while for any lighting plant in need of these "boosters" to write it for prices.

FRANK B. COOK, of 239 West Lake Street, Chicago, has been kept busy trying to supply the demand for his Type S. S. pole cable terminal, which has jumped into immediate favor. Among others the Bureau County Telephone Company, with its main office at Princeton, Ill., has installed these terminals in six of its exchanges. These exchanges are located at Princeton, Sheffield, Spring Valley, Tiskilwa, Lamoille and Walnut.

GREGORY ELECTRIC COMPANY, 54-56 S. Clinton St., Chicago, has issued its August bargain sheet of second-hand dynamos, motors, transformers, meters, arc lamps and instruments. As is usual, the sheet contains a complete list of standard machines at prices to make them move. The company offers a special discount of ten per cent. on orders for meters in lots of fifty or more, to be taken within one year, beginning Aug. 1, 1904.

SMALL DIRECT-CURRENT MOTORS.—Bulletin No. 34 of the Eck Dynamo & Motor Works, Belleville, N. J., is devoted to the latest and most approved designs of machines of the protected type, with the commutator and brush holders exposed, giving opportunity for supervision and enabling the operator to detect excessive overloads through sparking at the brushes. A complete price-list and tables of dimensional data of standard Eck machines are given in bulletin No. 35.

ELECTRIC APPLIANCE COMPANY, Chicago and San Francisco, in catalogue No. 22, illustrates a substantial line of electric railway material. The company is making a specialty of furnishing mica in any form, shape or size, ready for use. Catalogue No. 23 is devoted to electrical supplies for gas and gasoline engines and automobiles. The large stock kept constantly on hand allows prompt shipment to be guaranteed, while the standing of the company insures that the quality will always be the best.

THE B. F. STURTEVANT COMPANY, Hyde Park, Mass., is fitting up quarters in its big plant to be used for an emergency hospital, in case of accident to employes. It is to be equipped with all the appliances known to medical and surgical science for the proper care of the men who may get injured in the discharge of their duties until they can be removed to their homes. A graduate nurse and medical student will be in charge and a local doctor will attend to all surgical cases.

THE JEFFREY MFG. COMPANY, Columbus, Ohio, devotes bulletin No. 9 to instructions for the care and operation of direct-current electric generators. While primarily intended for generators of the Jeffrey type, the instructions are applicable to any well-designed direct-current generator and show the

result of care in their preparation. Booklet 77A describes the Jeffrey grab buckets for the automatic unloading of coal from cars, barges and vessels. These buckets are absolutely self-filling. Where desired, they may also be worked in ore, earth, clay, sand and limestone.

D'OLIER ENGINEERING COMPANY, Philadelphia, in Bulletin No. 7, describes and illustrates the De Laval steam turbine and electrically-driven centrifugal pumps. On account of their high speed steam turbines are well adapted for driving centrifugal pumps. The De Laval steam pump consists of a steam turbine direct-connected by means of a flexible coupling to a centrifugal pump, both turbine and pump being mounted on a common bed-plate and sold as a complete pumping outfit. Pumps are built in capacities from 60 up to 30,000 gallons per minute, and for heads up to 700 feet.

INDUSTRIAL APPLICATIONS OF ELECTRIC MOTORS.—The wide range of applicability of direct-current motors for industrial purposes is entertainingly presented in illustrated bulletin No. 218 issued by the Sprague Electric Company, 527-531 West 34th St., New York. Among the many installations where Sprague motors are directly connected to the machines operated, may be noted winches which are particularly adapted to hauling cars from tracks outside of factory buildings without using a switching engine, portable drills, silk looms, water gate valves, linotype machines and printing presses.

THE FRICK COMPANY, of Waynesboro, Pa., U. S. A., builders of the "Eclipse" ice-making and refrigerating machinery, Corliss engines and steam boilers, have an elaborate display of their machinery at the World's Fair, Agricultural Palace, Section XI, at which their patrons, friends and prospective purchasers are especially invited to call. They have a small refrigerating plant in operation on the grounds, and quite a number of various sizes plants operating in the city of St. Louis or immediate vicinity, to any of which their representative in charge, Mr. John C. Emmert, will be pleased to personally direct.

THE RUST WATER-TUBE BOILER.—In comparison with other water-tube boilers, the Rust type presents several features worthy of note. The boiler is composed of the familiar steam and mud drums connected by tubes. In its construction, however, no curved tubes are used, all tubes being straight and vertical, thus rendering the removal of scale an easy process and allowing the mud to settle to the lower drums from whence it may be blown out. These boilers are manufactured by the Rust Boiler Company, Pittsburg, Pa., which has recently issued a well-illustrated catalogue describing their advantageous construction.

EXTREMES MEET.—Persons visiting the "Big Engine" in Machinery Hall at the World's Fair, where the enormous Allis-Chalmers-Bullock 5000-hp steam-electric unit is the largest ever shown at an exposition, will have an opportunity of seeing beside it the smallest operating steam engines in the Fair. These little fellows, which are made with an accuracy and finish like clockwork, stand in a glass case just across an aisle from the big engine, in the space occupied by the International Steam Pump Company. There are two of them now operating, each working a direct-connected pump and throwing their tiny streams into a copper tank which stands between them.

SMALL PLANT ALTERNATING CURRENT SWITCHBOARDS.—To meet the demand for apparatus for single and three-phase stations containing 1150 and 2300-volt machines, the General Electric Company has introduced a line of alternating current switchboards for controlling units of capacities up to 200-kw. These switchboards, while simple in construction and requiring a comparatively small amount of space, contain all the devices necessary for the perfect operation of the systems. They are designed for one separately-excited or compensated-field alternator, one 25 or 35-light constant-current transformer, or two single-phase feeder circuits. The descriptive bulletin is No. 4381.

DE LAVAL PUMPS.—A report by J. E. Denton and William Kent, upon tests of three centrifugal pumps at the works of the company, forms the subject of Bulletin No. 9, issued by the De Laval Steam Turbine Company, Trenton, N. J. A 45-hp steam driven pump showed an efficiency of about 75 per cent. as the ratio of water horsepower to the calculated brake horsepower. The tests of the 175-hp electric motor pump gave an efficiency varying from .68 to .75. A two-stage compound pump at about 48 horsepower showed results equal to the other machines, and the tests proved that the pumps are well constructed and realize their maximum efficiencies at practically the designed conditions of life and power delivery.

THE BULLOCK ELECTRIC MFG. COMPANY, of Cincinnati, has issued bulletin No. 1026, devoted to belted multipolar motors and generators, types H and HI, which are admirably adapted to any service for which an open machine can be used. These machines are of strong, rigid construction, and are built for hard, continuous service. Bulletin No. 1002A of the same company treats of type N motors, which are especially designed and constructed for direct connection to machine tools and for other similar severe service, such as for electric crane and elevator work. Many of the largest machine shops are now equipped with electric drive, using these motors direct connected to the tools and operating on the Bullock multiple voltage system.

SCHUTTE & KOERTING COMPANY, 12th and Thompson Sts., Philadelphia, has issued catalogue No. 1, devoted to the universal double-tube injector. The injector is the combination of two jets—the lower jet proportioned for extreme temperature and for quick and strong action, which includes maximum high suction. The discharge is into the upper jet, where the water receives the additional strong impulse to carry it into the boiler. The pressure and volume from the lower jet correspond to the steam pressure. The varying volume insures the proper working at high steam pressure as well as at low, and increased pressure admits of increased high temperature. The injector is specially adapted for severe requirements as with steam autos and road engines.

ENGINEERING COMPANY OF AMERICA, 74 Broadway, New York, has issued a pamphlet on concrete construction, setting forth in an instructive manner the advantages of concrete as a constructive material both when used alone and in combination with steel re-enforcement. The superiority of concrete as a fire resisting material was emphasized with great clearness in the Baltimore fire. The steel imbedded in concrete provides for all strains, while the concrete protects the steel from corrosion, due to the fact that steel and concrete expand at approximately the same rate when subjected to excessive temperatures, while partitions and floor arches do not buckle or break. The comparative cheapness of concrete invites an investigation of its merits by those who contemplate building.

THE CUTLER-HAMMER MFG. COMPANY has issued the following bulletin sheets of price-lists and diagrams of connecting circuits for insertion in the loose-leaved catalogue of the company. No. 52, on self starters with reversing switches for freight elevators, dumb waiters, etc.; No. 67½, describing compound non-reversible drum controllers for printing presses, etc.; No. 73, dealing with outfits for small motor-driven pumps used in connection with open tanks and for operating compression tanks; No. 75 and No. 76 devoted to compound non-reversible and full-reverse slate front type machine tool controllers, respectively; No. 77 and No. 78, describing the drum compound full-reverse and non-reversible machine tool controllers; No. 79 and No. 93, listing resistances for compound drum type machine tool controllers and "Carpenter" type resistance units, and bulletin No. 92, giving the constructive dimensions and list price for each size of "Simplicity" type interlocking and non-interlocking dimmers.

A PUMPING ENGINE OF EXCEPTIONAL ECONOMY.—In view of the intense interest at present manifested in the steam economy of prime movers, both of the reciprocating and turbine types, it is impossible to pass without remarking some results lately obtained in an official pumping engine test at the Park Avenue pumping station, Chicago. The engine is of the Worthington, duplex, reciprocating, triple-expansion type, having semi-rotary steam valves, but no fly-wheel. The latter is replaced by compensating cylinders so arranged that their pistons retard the motion of the main piston during the first part of the stroke, but assist it toward the close, giving a uniform resultant thrust The pistons of these auxiliary cylinders work against air under pressure from a tank. The engines are vertical and the weight of the pistons, plungers and rods is counterbalanced by another auxiliary balancing plunger, also working through the medium of water against air under pressure. The capacity of the engine is about 22,000,000 gallons per day against a total head of slightly over 121 feet, and 660.9 horse-power were indicated in the test. The duty obtained was 174,735,801 foot pounds per 1000 lbs. of steam used, corresponding to an economy of 11.32 lbs. of steam per net horse-power delivered in water lifted, or 10.01 lbs. of steam per I. H. P. The steam pressure was 144.45 lbs. per sq. in., with 154° F. superheat at the throttle, the steam cylinders being provided with jackets and re-heaters. Two other engines of the same design in the Central Park Avenue station and three more in the Springfield Avenue pumping station have all shown under test an economy of steam less than 11 lbs., although the economy per delivered horse-power was not as high in the test quoted. These tests were carried out under the supervision of the Bureau of Engineering of the City of Chicago and, together with the engines and the power station, are fully described in a pamphlet distributed by Henry R. Worthington, of New York City.

TESTS FOR TIMBER TIES.—Up in the Mining Gulch at the World's Fair in St. Louis there are now two exhibits which perhaps equal any in the Fair for interesting features, while standing far above the most in permanent value. These are the coal testing plant of the United States Geological Survey and the timber preserving plant of the Bureau of Forestry. The Mining Gulch lies between the Palace of Mines and Metallurgy and the Inside Inn. Its entrance is diagonally opposite the southeast corner of the Mines and Metallurgy Building. The Government coal testing and timber preserving plants stand along the railroad tracks which run up the Gulch and are near the entrance. They are easily recognized from the fact that each building is painted with the red paint which is so commonly used on country barns. Each plant will depend for its operation, or value, largely upon Allis-Chalmers Company's machinery, in each case loaned by the company. The work of the coal testing plant will be the determination of the respective fuel values of every grade of coal which may be submitted. A 250-horse-power horizontal Allis-Chalmers engine in this plant will not only supply power for the various mechanical operations to which the samples of coal will be subjected, but will also serve to give practical tests through its power-producing qualities of the actual values of the various coals. The samples of coal will be analyzed, burned under boilers under varied conditions, coked and used for gas producing. Their values for gas production and the power qualities of the gases will be tested in a gas engine. Records of every test will be kept and it is believed that before the Fair is over data will have been secured which may result in the early development of several new coal fields in the country. The timber preserving plant, which stands about a hundred yards farther up the Gulch than the coal testing plant, is under the direction of Dr. H. Van Schrenk of the Shaw Gardens, St. Louis. Its special work will be to test all the various methods offered for preserving railroad ties. For this purpose the Allis-Chalmers Company has loaned, free of charge, a tie-treating retort and two tanks for the preservative solutions. The system supplied consists in placing the ties in the retort, where the first operation is to dry out all of the water and sap by heat and exhaust all of this and the greater part of the air from the retort proper pumps. Then, while the pores of the wood are all open and practically free from vapor, moisture or air, the preservative mixture is let into the retort from the tanks. The preservatives are thus, under the influence of the vacuum in the pores of the wood, carried into every part of the ties or timbers, no matter how thick or long they may be. The great need of finding some process for making timber for railroad ties last in the ground beyond its natural life comes from the practical exhaustion of the country of its supplies of such good timber as white oak for this use. Railroads must to-day use timber of such kinds as they can get for ties and much of this is of very inferior quality. In order to protect these poorer classes of ties from early decay many methods of preservative treatment have been devised and almost every one has shown good results under certain conditions. At the plant now established in the Gulch it is intended to treat various lots of ties by various processes. Each batch of ties will then be put into regular service in some railroad track and a record kept of each tie until it is worn out or rotted out. As these tests and records will be official, they will of necessity carry great weight.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED AUGUST 9, 1904.

[Conducted by Rosenbaum & Stockbridge, 140 Nassau St., N. Y.]

766,810. ELECTRIC HAMMER; Joseph Chambers and Corydon L. Cole, Minneapolis, Minn. App. filed April 25, 1904. Two solenoids with the circuit connections thereto are employed, in connection with a reciprocating plunger subject to the solenoids and a magnetically-actuated switch for cutting the solenoids into and out of circuit alternately.

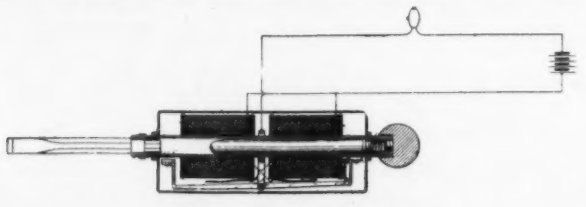
766,856. ELECTROMAGNETIC TRACTION DEVICE AND BRAKE; Charles A. Wells, Chicago, Ill. App. filed Dec. 10, 1903. The traction power of the driving wheels of the locomotive is increased by means of an electric current which magnetizes the wheels and causes them to tend to pull the locomotive down toward the rails and thus increase the friction between the wheels and the rails. An emergency brake is also employed, the shoe of which is capable of being magnetized to further increase the bearing effectiveness of the wheels.

766,865. LOCKING DEVICE FOR ELECTROMAGNETS; William Baxter, Jr., Jersey City, N. J. App. filed Sept. 22, 1903. This device is intended for use in connection with a plurality of magnets where it is desired that when one of the magnets is operated, the others shall be locked. A locking bar is employed in connection with the magnets, having a plurality of angular slots, together with pins connected to the magnet cores and adapted to coact with the slots to move the locking bar or to be engaged by the slots upon a movement of the locking bar.

766,935. CONTROLLER FOR TROLLEY POLES; Herman R. De Long and Rector Seymour, Warren, Pa. App. filed May 25, 1904. A weight is employed to overcome the force of the actuating spring for the trolley pole, whereby the pole will be pulled downward as soon as the trolley leaves the wire, in connection with a trip for throwing the weight into action.

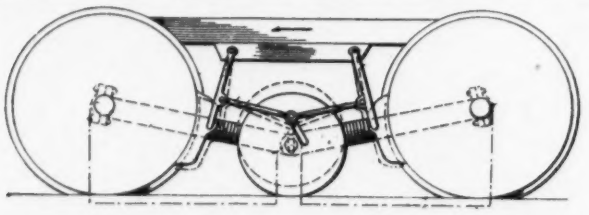
766,952. ELECTRICAL CONTACT DEVICE FOR INTERMITTENTLY ESTABLISHING CIRCUITS ON MOVING CARS; Jefferson D. Keen, Cincinnati, Ohio. App. filed March 18, 1904. Contact pieces are provided, located exterior to the car in connection with pivoted arms carried by the car and having conductor wires mounted therein, and metallic brushes removably secured in said arms and adapted to make contact with said contact pieces in the travel of the car, to establish a circuit.

766,965. UNDERGROUND CONDUIT JOINT; William L. McGowan, Philadelphia, Pa. App. filed Dec. 1, 1903. A sheet metal inclosing wrapper is used at the joint between two conduit sections which has its surface provided with perforations the edges of which are flanged outward and also have projecting portions directed toward the sides of the conduit sections to hold the body of the wrapper slightly away from said sections, and cement mortar surrounding the wrapper and extending through its perforations and under the same for sealing the joint between the sections and inclosing the wrapper.



766,810.—Electric Hammer.

767,002. LIGHTNING ARRESTER; Charles T. Mason, Sumter, S. C. App. filed April 9, 1904. A choking coil offering an irregular path for the current, with its proportionate resistance, is combined with a grounded conductor so formed and disposed with relation to the coil and an intermediate insulation that the conductor is exposed to the coil at a multiplicity of successive points at which the current in its passage along the coil may jump to the conductor and pass to ground and thus be dissipated.



766,856.—Electromagnetic Traction Device and Brake.

767,015. ELECTRIC THERAPEUTIC MACHINE; Harry R. Slaughter, Los Angeles, Cal. App. filed Oct. 22, 1903. In connection with the usual battery, induction coil and current interrupter, electrically connected thereto, a vibrator is employed electrically connected in multiple with the primary of the induction coil and with one side of the secondary of the induction coil, together with an electrode connected to the other side of the secondary of the induction coil.

767,018. TROLLEY STAND; Bruno Stenvall, New York, N. Y. App. filed Nov. 10, 1903. The purpose of this invention is to provide means for exerting a constant tension upon the trolley pole in its different angular positions, the same consisting of a block, a trolley pole hinged thereto, a lever hinged to the pole, a lever hinged to the block and first-named lever and a spring so connected to the first-named lever as to exert a constant tension on the pole in its different positions.

767,025. TROLLEY BASE AND POLE OR ARM THEREFOR; George Volker, Albert Goerlitz and August Goerlitz, Buffalo, N. Y. App. filed Oct. 16, 1903. The movable support to which the trolley arm is pivoted is supported between two sets of roller bearings, the set which sustains the weight having the rollers horizontal and the other having its rollers vertical, to distribute the tensioning strain of the trolley pole.

767,050. ELECTRIC LOCK; Adalbert Haesner, Munich, Germany. App. filed July 1, 1903. This invention, which is designed to provide a lock which will permit a door to be locked and unlocked from a distance, consists of an electro-magnet, means for supplying current of opposite polarity, a polarized armature operated by the magnet, a detent arranged to hold the door and means operated by the polarized armature for locking and unlocking the detent.

767,052. ELECTRIC SWITCH; Arthur E. Handy, Providence, R. I. App. filed Aug. 29, 1903. In the switch of this patent are employed a reversing arm, a controlling arm, an electric contact between said arms, means whereby the controlling arm may be moved to stop and start the elevator car on which the switch is mounted while the reversing arm remains at rest, means for engaging and moving the reversing arm to make connection with its contact pieces in advance of that made by the controlling arm only when it is desired to reverse the motor.

767,105. MAGNETIC SEPARATOR; Myron Dings, Milwaukee, Wis. App. filed Aug. 7, 1903. Details of an apparatus intended only for occasional use and for the magnetical separation of comparatively small quantities of material insufficient to justify the maintenance of machine-driven mechanism.

767,112. HAIRPIN; Clara E. Koehl, Philadelphia, Pa. App. filed June 3, 1904. The hairpin has a core composed of dissimilar metals and a non-metallic enveloping body leaving one or more points or the core exposed.

767,128. SEWING MACHINE MOTOR; Homer J. Young, Toledo, Ohio. App. filed Sept. 8, 1903. Details.

767,140. TRAIN SIGNAL; Filip Feher, Trenton, N. J. App. filed April 14, 1904. The train signal is provided with a spring-influenced lever, and has a frame depending therefrom. The frame carries a solenoid, and a catch is employed adapted to engage the solenoid core, together with a contact adapted to be closed by the frame.

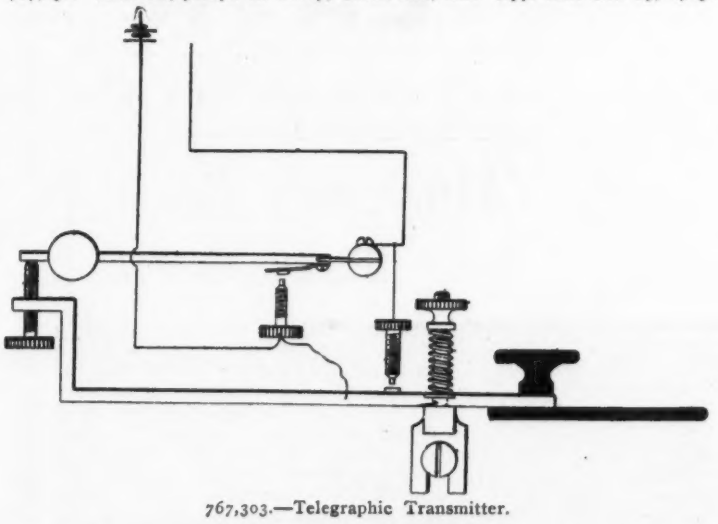
767,163. ELECTRIC SWITCHBOX OR CASE; George E. Neuberth, Newark, N. J. App. filed Oct. 3, 1903. Details.

767,190. ELECTRICAL SIGNALING DEVICE FOR RAILROAD CROSSINGS; Joseph F. Weinschenk and Clifford H. Blodgett, Durand, Mich. App. filed Jan. 14, 1904. In this appliance the electrical circuits connecting the relays with the tracks and those controlling the signal bell, are open circuits until closed between track and relay by the wheels and axles of the approaching train, the closing of which energizes one pair of the electromagnets of the relay, thereby closing the circuit through the signal bell and sounding the alarm.

767,206. INSULATED RAIL JOINT; Edward A. Condit, Jr., Newark, N. J. App. filed Jan. 27, 1904. A joint connecting plate is employed having a lower portion adapted to engage the base flange of a rail, an upwardly projecting upper portion and a rib at the inner face of said upper portion, wedge-shaped in cross section.

767,256. ELECTRIC SEMAPHORE SIGNAL MECHANISM; Bruno O. Wagner, Amsterdam, N. Y. App. filed May 7, 1903. An electric motor for operating the semaphore blade is employed, said motor being adapted for operation by a three-phase electric circuit in which is included three main conductors and a neutral wire therefor. The motor also includes means for short-circuiting one phase of the circuit at predetermined times to cause a current to flow through the neutral wire and operate an indicating bell at the signal-operating station, so that the operator may readily ascertain when the signal blade on the semaphore is set to its proper position.

767,258. BRAKE; Joseph E. Berry, Carterville, Mo. App. filed Oct. 29, 1903. The brake is actuated in part by electric energy and in part manually, the adjustment of a single lever under the control of the operator serving to apply the brakes with greater or less force and the movement of such lever simultaneously closing the electric circuit.



767,303.—Telegraphic Transmitter.

767,273. INSULATED RAIL JOINT; Percy Holbrook, New York, N. Y. App. filed Nov. 13, 1903. Details.

767,298. LOCKING MECHANISM FOR COIN RECEPTACLES; Robert J. Louis, New York, N. Y. App. filed April 6, 1903. A magnetic latch for the receptacle-closure is provided, the moving member of which is located within the receptacle but is operable by magnetic influence exerted thereon from the outside of the receptacle.

767,303. TELEGRAPHIC TRANSMITTER; Horace G. Martin, Brooklyn, N. Y. App. filed May 7, 1904. The purpose of this invention is to enable operators to send Morse signals by means of a key, but by a greatly reduced number of movements of the latter, so as to avoid the nervous strain involved in the operation of the ordinary Morse key in rapid work, and consists of a transmitter comprising a circuit controller capable of making and breaking a circuit at a uniform rate, a key normally engaging said controller and preventing it from operating, and a contact for said key, the key being capable of two movements from its normal position, one of which withdraws it from engagement with the controller, while the other brings it into engagement with its contact.

767,316. SAFETY DEVICE FOR ELECTRICALLY PROPELLED VEHICLES; James H. Spencer, New York, N. Y. App. filed April 13, 1900. Details of apparatus whereby the motor and the source of electricity are disconnected in case of accident to bring the motor and consequently the vehicle to a stop.

767,322. PRINTING TELEGRAPH; James Dundas White, London, England. App. filed Jan. 2, 1904. Means are provided for rotating the axle which carries the type-wheels or cylinder by electro-mechanical devices controlled by a few circuits, so that the opening and closing of these few circuits separately and in various combinations may be used to rotate the axle to many different degrees and to provide for the printing of many different characters.

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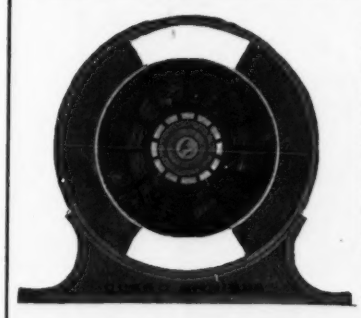

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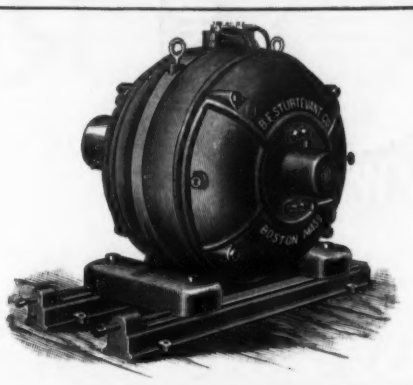

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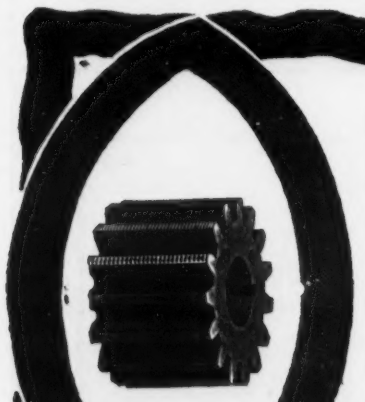

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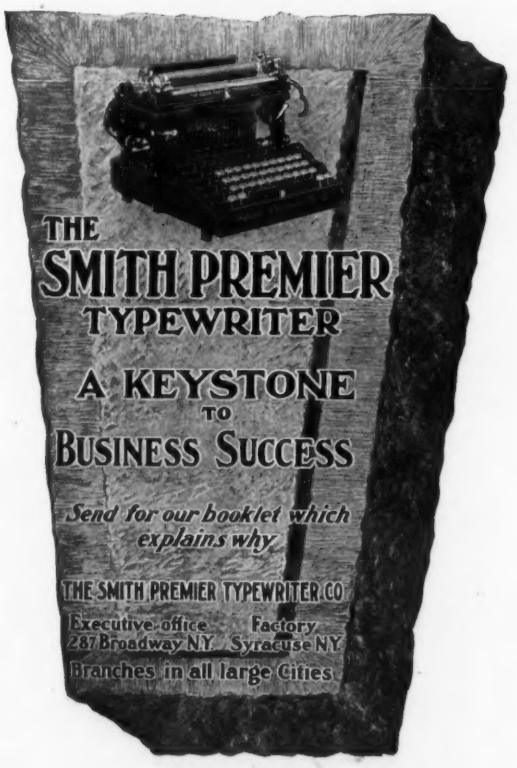
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